POPULAR SCIENCE

MONTHLY

MECHANICS - AUTOS - HOMEBUILDING

How to Build a CABIN FOR $200

25¢
February

What You'll Find Under the Hood of the New Chevrolet

PAGE 100

New! GIANT BEACH BALL OVER 3 FEET HIGH

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$1.00

1

Exciting new fun for young and old! Gay, multi-colored giant rubber ball features one piece seamless construction. It is strong enough to stand on! Patented blow-up feature can't leak! Inflates easily by mouth or pump. Replaced without charge if you ever break it under ANY condition!

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Trouble-Free Operation Guaranteed

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6

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2

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3

7

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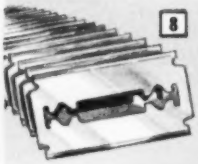

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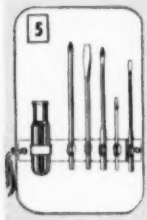

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11 STOP SPENDING MONEY ON CAR WASHINGS

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14 Complete 2-UNIT SET
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15

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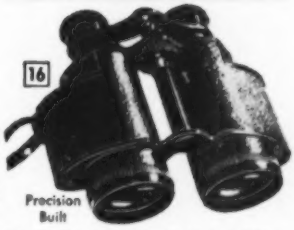

16 Precision Built

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FEBRUARY, 1953

How You Restore a Model T Ford

***Rusting for years** in an unroofed barn, this tin lizzie had been taken over by the field mice and birds. Then Associate Editor R. P. Stevenson spotted treasure trove beneath the rust, lugged it off for rebuilding. For his account of its reconstruction, see page 190.*

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If over 2 years, score 5 points; over 1 year but less than 2, 10 points; less than 1 year, 15 points ☐

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7. Are you training yourself for advancement?
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The Amazing New PROTO Torque-*Limiting* Wrench with Automatic Release!

Use it in the dark, in noisy locations, in "blind" spots, in water or oil, with gloved hands! Automatic release tells you "when", without looking or listening—prevents over- or under-torquing.

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Easy To Use
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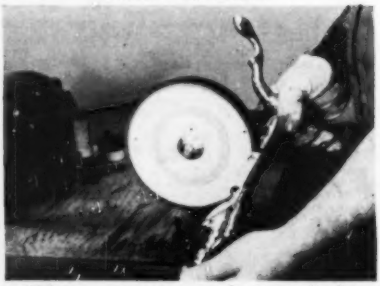
NEXT MONTH . . .

How to Buff



Who wants to spend time daubing metal polish when he can let a quarter-horse motor work for him? Certainly not writer Bill Vogel, whose enthusiasm for power buffing shines as brightly as the work he turns out. If the brass and copper around your home are a little winter-weary, read the low-down next month on the easy way to a gleaming polish.

NEW WONDER LUBRICANT

used in jet engine and atomic energy plants . . . now available for your car

AUTOMOTIVE

LIQUI-MOLY

Plates engine parts for 3,000 miles

LIQUI-MOLY is the new plating process that permanently coats engine parts with the most slippery metal known: Molybdenum (MoS_2). This is the new wonder lubricant used in jet engine and atomic energy plants. Add it to your regular motor oil; the action of your motor does the rest.

Drastically reduces engine friction

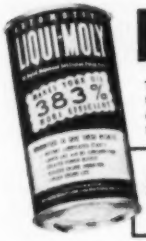
The LIQUI-MOLY plating cannot be squeezed out or thrown off engine parts like oil. It *stays on* cylinder walls, piston rings, valves and bearings, giving instant lubrication when you press the starter.

Instead of metal grinding against metal, engine parts slide smoothly on millions of microscopic moly "ball bearings." Friction is drastically reduced, resulting in lower gas and oil consumption, greater power output and smoother performance.

LIQUI-MOLY GIVES YOU:

- **Reduced consumption of gas and oil**
- **Instant, lubricated starts on cold days**
- **Safe break-in of new engines at high speeds**
- **Protection if oil or water is accidentally lost**
- **Greater power output—longer engine life**

NATIONAL BUREAU OF STANDARDS, *Journal of Research, April 1951 — 292:* Static Friction Tests with Special Lubricants: "The lubricants containing MoS_2 gave the lowest friction . . . about 50% to 60% less than reference oil (Navy 210 Oil, S.A.E. 10)."



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LIQUI-MOLY

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$1.50 One-treatment size for passenger cars in sealed 10½ oz. tamper-proof can.
32 oz. economy size. $3.75.

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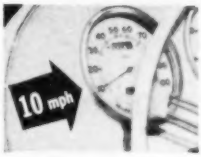
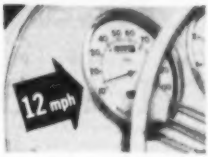
PHOTOS OF TEST BY "SPEED AGE" MAGAZINE
(in the January, 1952 issue)
Reporting a 20% increase in gas mileage





BEFORE LIQUI-MOLY. With one rear wheel jacked up, car was put in high gear and *throttle pre-set at a given point.* After ten-minute warm-up speedometer registered ten m.p.h.

AFTER LIQUI-MOLY. At this point, LIQUI-MOLY was poured into crankcase. 30 minutes later, the speedometer read 12 m.p.h., on the same throttle setting—an increase of 20%!

ONE TREATMENT LASTS 3,000 MILES

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NO RISK TO YOU: If LIQUI-MOLY *does not improve your car's performance, return the empty can for full refund.*

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1155 Broadway, New York 1, N. Y.

Please send me:

_____ cans $1.50 size LIQUI-MOLY $_____

_____ cans $3.75 size LIQUI-MOLY $_____

Add 15¢ for postage and handling $ .15

TOTAL $_____

NAME _____
PLEASE PRINT

ADDRESS _____

CITY _____ ZONE ____ STATE _____

(Send cash, check or money order) PS1

New "500" telephone. It has already been introduced on a limited scale and will be put in use as opportunity permits, in places where it can serve best. Note new dial and 25 per cent lighter handset.

It adds miles to your voice

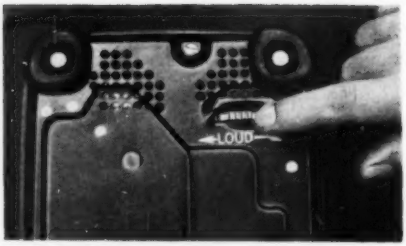
For years the telephone you know and use has done its job well—and still does. But as America grows, more people are settling in suburban areas. Telephone lines must be longer; more voice energy is needed to span the extra miles.

Bell Telephone Laboratories developed a new telephone which can deliver a voice ten times more powerfully. Outlying points may now be served without the installation of extra-heavy wires or special batteries on subscribers' premises. For shorter distances, the job can be done with thinner wires than before. Thus thousands of tons of copper and other strategic materials are being conserved.

The new telephone shows once again how Bell Telephone Laboratories keeps making telephony better while the cost stays low.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in scientific and technical fields.



Adjustable volume control on bottom of new telephone permits subscriber to set it to ring as loudly or softly as he pleases. Ring is pleasant and harmonious, yet stands out clearer.

QUICK FACTS ON NEW TELEPHONE

Transmitter is much more powerful, due largely to increased sound pressure at the diaphragm and more efficient use of the carbon granules that turn sound waves into electrical impulses.

Light ring armature diaphragm receiver produces three times as much acoustic energy for the same input power. It transmits more of the high frequencies.

Improved dial mechanism can send pulses over greater distances to operate switches in dial exchange.

Built-in varistors equalize current, so voices don't get too loud close to telephone offices.

Despite increased sensitivity of receiver, "clicks" are subdued by copper oxide varistor which chops off peaks of current surges.

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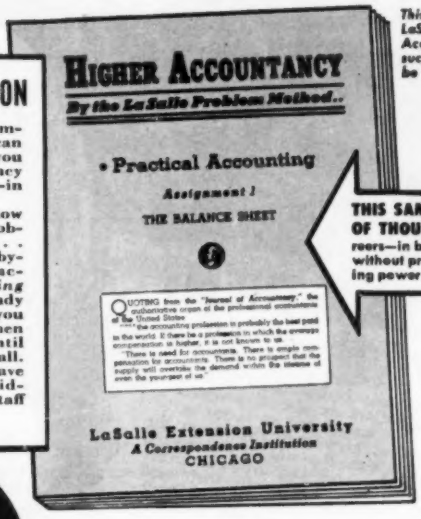

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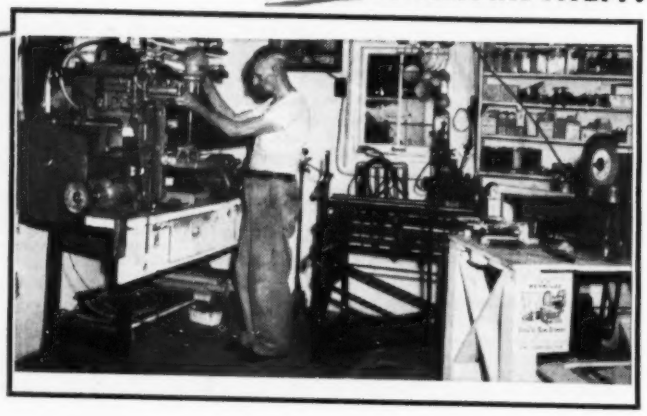
EARN WHILE YOU LEARN TO REPAIR THEM!



READ WHAT MR. PIPPIN SAYS: . . .

Mr. Marion A. Pippin, 1139 E. Lincoln Ave., Decatur, Ill., before enrolling with CTS wrote, "I have been a foreman in a large plant here for 39 years and now retired. My age (60 years old) is against me." Then he enrolled and reported, "I certainly have enjoyed your training. The way your lessons are prepared is very fine." Then he graduated and wrote, "Well, I am now in the phone book in 4 places in the yellow pages. My business is getting better all the time." Mr. Pippin, now 61 years old and a grandfather five times, has found a business with Real Security in his Fix-It Shop. You can do the same.

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often charged for making ordinary repairs. We show you how to repair refrigerators, vacuum cleaners, washing machines, motors, etc., etc.

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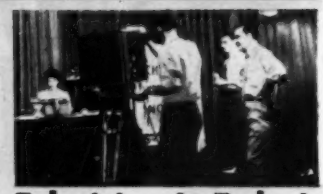

Television Is Today's Good Job Maker

In 1951 over 15,000,000 homes had Television sets, more are being sold every day. Television now reaches from coast to coast. 108 TV stations are already operating, over 1800 more have been authorized. This means new jobs, more jobs, better pay for trained men. The time to act is NOW! Start learning Radio-Television servicing or communications.

Make Extra Money in Spare Time While Learning

Keep your job while training. Many NRI students make $5, $10 and more a week extra fixing neighbors' Radios in spare time. I start sending you special booklets that show you how to service sets the day you enroll. Multitester you build helps discover and correct Radio troubles, gives PRACTICAL EXPERIENCE on circuits common to Radio and TV.

I Trained these Men at Home

Laborer Finds Success in Radio-TV

"I was a laborer with no future. Now I have a position that pays well. My spare time servicing pays good money, too. Thanks to NRI."—Robert Ford, Johnstown, Pa.

Switched to TV Servicing

"I recently switched from studio work and am now holding a position as TV service technician. Enjoy my work more and more." —Norman Ward, Ridgefield Park, N. J.

Paid for Course, Car in Spare Time

"By the time I graduated I had paid for my course, a car and testing equipment. I can handle any job in Radio-TV."—E. J. Streitenberger, New Boston, Ohio.

$10 to $15 Week Spare Time

"Four months after enrolling, was able to service Radios . . . averaged $10 to $15 a week spare time. Now have full time business." — W. Weyde, Brooklyn, N. Y.

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"A former employer recommended NRI training to me. Now employed as transmitter operator in Harrisburg."—Albert Herr, New Cumberland, Penna.

AT HOME for Good Jobs in TELEVISION

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Power Monitor
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Television Receivers
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Assistant Operator

GOVERNMENT RADIO
Operator in Army, Navy, Marine Corps
Airways Operator
Forestry Dispatcher

AVIATION RADIO
Transmitter Technician
Airport Transmitter Operator

TELEVISION
Pick-up Operator
Television Technician
Remote Control Operator
Service and Maintenance Technician

POLICE RADIO
Transmitter Operator
Receiver Serviceman

Control Operator, Station WEAN

"Received my License and worked on ships. Now with Station WEAN. NRI Course is as complete as any radio course can be." —Raymond E. Arnold, Rumford, R. I.

Lost Job, Now Has Own Shop

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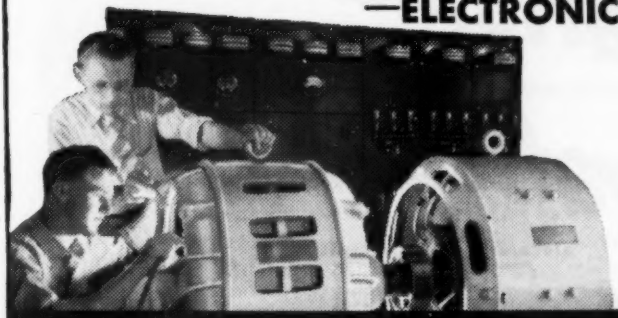

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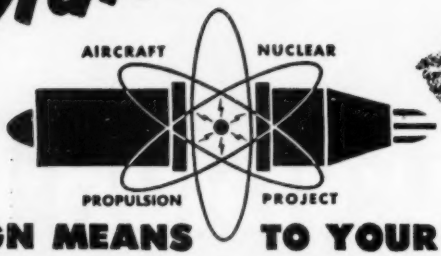

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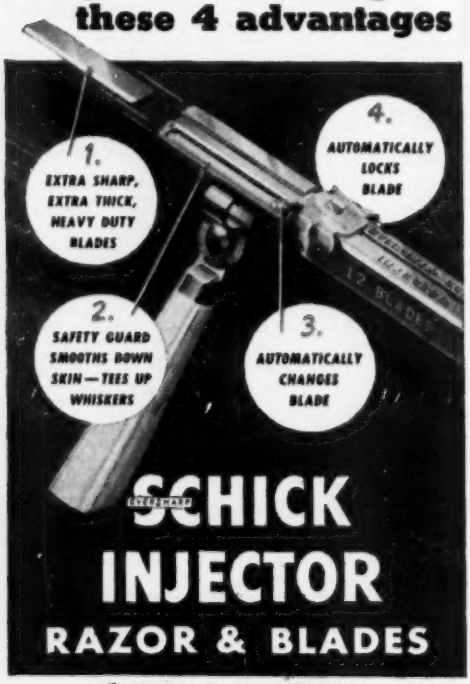

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Letters

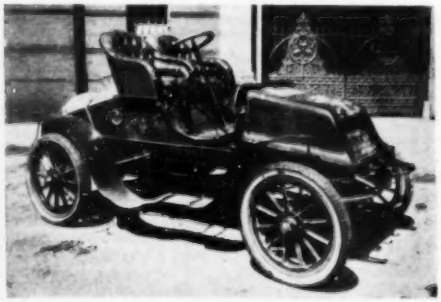
Mail-Train Story Pleases Mailman

That's a very good piece on the mail train in your December issue [p. 81]. So many free-lance writers sound superficial, but Mr. Comstock knows his subject. The article is definitely "post office" as we in the PO know it. The screwball address writers got a proper ribbing too.

CITY BAG TOTER, Chicago.

First Car to Cross the U.S.

Travel is speeding up a bit. I see that Louie Mattar has driven across the country nonstop in about 90 hours [Nov. '52, p. 174].



The first car to cross the U.S., in 1903, arrived in New York 63 days after it left San Francisco. The car, a Winton [above], is now in the Smithsonian Institution.

RALPH PETERS, NYC.

Transformers for Tachometers

The Stancor A4352 transformer used in the article "How to Build a Rev Counter" [Dec. '52, p. 174] has been discontinued. Will the A4351 work just as well?

KENNETH GREENBERG, CHICAGO.

Stancor's A4351, essentially the same as the A4352, will work fine. Other usable transformers include the Thordarson T20-A00, the UTC R29 and the Merit A2924.

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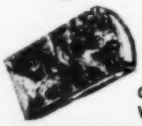

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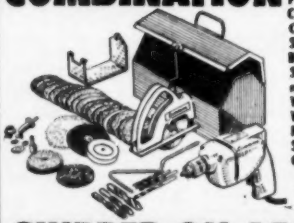

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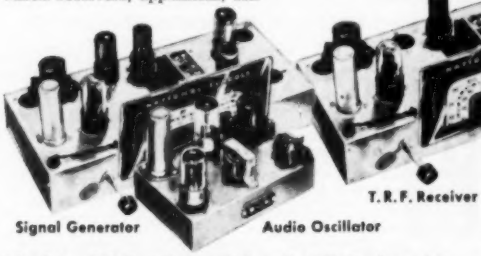

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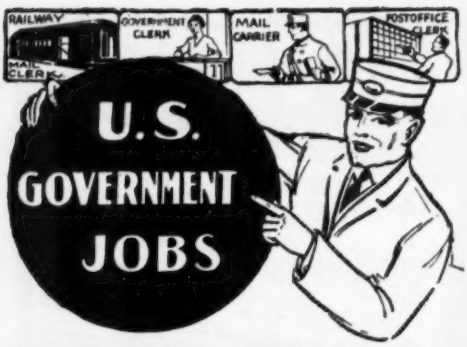

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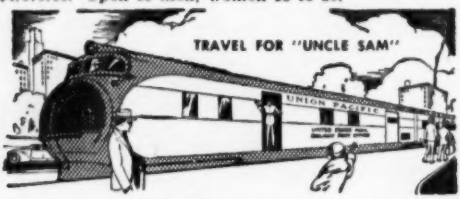

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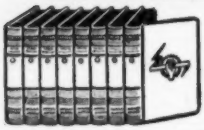

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"How to Become a Mail Order Millionaire"

Read how Gilbert on a "peanut" investment built up to $350.00 A DAY. Learn how Zimmerman started a mail order business on a buck private's pay and spiraled $16.80 into a big yearly income. See how a Chicago clerk quit a $75.00 job and now makes $22,000 a year in his own Mail Order business. Read how a southern boy made a fortune selling war-surplus parachutes which he bought as he went along. All Free! Send name on coupon for a copy of this fascinating reprint of "How to Become a Mail Order Millionaire" from Mechanix Illustrated plus details on the L.W. Mail Order Survey.

Start on a SHOESTRING!

The real-life stories of success in Mail Order read like fairy tales. If I had not personally known these people their stories would be hard to believe. Yet they are not only true, but they represent just a few of the hundreds of "little operators" who have been swept into big money by Mail Order.

GAINES. I personally guided his start when he invented an automatic pants presser. He started with one little ad in one magazine. Four years later he **retired** — with enough real estate to keep him in cash income the rest of his life.

VAN MARK. I worked with him for six years. I met him when he was a wagon man for a tea and coffee house, knocking on door;. He went into Mail Order on nothing—made money from the start —ended up six years later with savings of $50,000 and an income of $5000.00 a year for life without further work.

DUGGAN. A few years ago he was a truck driver. Started fooling with Mail Order in a spare room in his spare time. Last year he said, "I don't know how much I'm worth—after you get the first million you quit keeping track."

MRS. NIXON. Started a small Mail Order business at home—just to keep occupied. It looked good and she came to me for advice. I showed her how to expand. In two years the business got so big her husband resigned his job to help manage it.

FOXMAN. Foxman worked as a hack writer at $70 a week. He had idle time in the evenings—ran an ad offering something he didn't have—got so many **orders he had to find a source of supply. He made $18,000 the** first year. He gives me credit for "showing the way."

JORGENSON. Consulted me about a specialty product. On my advice he ran one ad to "test" its saleability. That ad brought sales of $50,000. In his first year he did a business of nearly a half million dollars. His original investment was less than a thousand.

These things I have seen. These people I have helped to the realization of their dreams — these and hundreds of others. My own fortune was made in Mail Order. And now my secrets can be yours.

L. W.

Have you ever thought of running a profitable little sideline right from your home? Has it occurred to you that *you are just as capable as anyone else* of making money on a product or service that can be sold by mail? Have you ever looked into the Mail Order business as it's run (on tiny investments) by innumerable small operators?

Forget about Sears and Ward's! *Read about the "little fellows"* . . . clerks, teachers, vets, mechanics, salesmen and others . . . who are packing Mail Order items in bedrooms, spare rooms, attics, garages, cellars . . . dumping them in the Post Office . . . and quietly banking the fistful of Money Orders, cash and checks delivered, to them daily by the mailman.

An annual business of almost a billion dollars is done by "little fellows" who advertise and sell *just one item!* The Department of Commerce of the United States says, "A number of the most successful obtain incomes as high as $40,000 to $50,000.00."

It's an incredible story . . . a story of a business that's wide-open for newcomers . . . with opportunities for income far-and-away greater than you can ordinarily hope to attain by holding down a job. And in Mail Order you can stay as small as you wish—run your deal as a $50 or $75 weekly sideline—or consider jacking it up into really big figures as a full time operation.

Glance at the examples at left. *These true stories are far from unusual.* Multiply them by the hundreds and you begin to get an idea of what can be done . . . what *is* being done . . . in the phenomenal Mail Order field.

• • •

Yet, if you **were to jump blindly into Mail** Order your chances would be slim. A peculiar brand of "know-how" is vital in this little - known, little - understood business. *This is fortunate for you.* If any Tom, Dick, or Harry would "click" in Mail Order, the field would have been overloaded years ago.

But now you have the opportunity to learn the authentic secrets of successful Mail Order operation. They are revealed for the first time, step by step, in an extraordinary new Survey . . . *the L.W. Confidential Mail Order Letters.*

This Survey is not a course—not a book —not a group of lessons. It is a simple guide that anyone can follow. It shows you how to pick the right product for Mail Order. It shows you exactly how to start a profitable business *fast*, with cash or Money Orders in the envelopes you receive. It shows how to buy your product out of the very money you get in the mail, so you don't have to tie up cash in large supplies of your product. It gives you actual examples of ads and letters, *analyzed to show how and why they make money.* It demonstrates the months to start, the time to expand, the best way to get prospects' names. It reveals from A to Z the confidential facts that have made fortunes for Mail Order operators who use them.

Mail the coupon today, or simply send your name and address on a postcard. No salesman will call. We will mail, postage prepaid, a *Free* copy of "How to Become a Mail Order Millionaire" and along with it will give you complete facts about the L.W. Mail Order Survey. Read the facts. Then decide whether you would like to spend spare time or full time in a profitable, fascinating Mail Order enterprise. If you think you would like to follow the footsteps of hundreds of others who are now making good money in this way, you can get your L.W. Survey and begin at once.

Please don't decide to write us "a little later." Send your name *now*, before you forget. This one little act might be the first step to a future of independence and wealth.

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Mail me a free copy of "How to Become a Mail Order Millionaire" and details about the L. W. SURVEY. It is understood there is no charge at any time, and that I am not under the slightest obligation. After reading, I will decide whether I want to use the L. W. Confidential Letters to help me start a Mail Order business at home.

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Not if you know a few simple things about your television set . . . not if you know when you really need a serviceman . . .

and when your trouble can be corrected with a minor, simple, safe adjustment you can make yourself . . .

You've seen a serviceman come in to work on your set. He taps this and twists that. Then he either replaces a tube, or makes an adjustment on a part. All he has to do is recognize and locate the trouble, and then make the correction.

You don't have to be a mechanical genius to be able to make many of these same adjustments on your set yourself. If you have ever put a new washer on your water faucet, or changed a tire on your automobile, or attached a new plug to an electric cord—you have enough "mechanical background" to be able to take care of all "nuisance repairs" yourself, and probably of most other things that go wrong with a set.

Amazing New TV Owner's Self Repair Book Takes the Mystery Out of TV Repairs

With the amazing new TV Owner's Self Repair Book, you can have a television expert at your side whenever you need it. Now, every time your set begins to flicker or jump, or becomes distorted or dissolved into lines or zags—a flick of the finger to the right page **SHOWS YOU EXACTLY WHAT CONTROL** knob to turn to correct the trouble in less than one minute! From now on, every time you're annoyed by "ghosts," snow or weak channel reception—the TV Owner's Self Repair Book shows you how to effect a quick 15-minute repair job that eliminates these faults and restores the set to perfect, movie-clear reception.

IT HAS BEEN PROVEN THAT 1 OUT OF EVERY 3 TV FAULTS IS CAUSED BY A WEAK OR BURNT OUT TUBE. Just by replacing a tube you can correct fully 33⅓% of the troubles that may develop in a set. The TV Owner's Self Repair Book shows you how to safely locate and change the bad tube in less than 5 minutes.

Contains special tube diagrams that spot faulty tubes immediately . . . a complete section on antennas . . . interference . . . covers T.V. set models from 1947-1952 . . . all makes . . . all sizes.

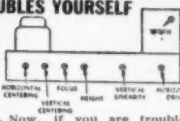
When you check your trouble and find that it is due to a faulty tube, you are led right to it. You simply find the diagram for your set and the one (or more) tubes you are to check—and **THE ONE TO REPLACE** are pinpointed for you! You are directed right to it. No blind guessing or hunting for the bad tube. **ONLY IN THIS BOOK,** has there been developed a special identification method to make it a cinch to locate the bad tube. Each tube in each diagram not only carries its usual trade identification number, but also a special letter to identify its function and location as well. It's (1) find the trouble, (2) find the tube, bingo, (3) replace the tube—and that's all there is to it!

Which Type of Antenna Is Best for Your Set

The special chapter on antennas explains what an antenna is supposed to do; the reason for the different shapes and arrangements; the reason for "stacking" and multiple antennas; how to "orient" an antenna for best reception; the need and use of a "rotator"; the special antennas for "fringe" areas; how to install, change or add antennas and parts; information on complete antenna installation kits which are available. Just about everything practical that you need to know about antennas.

Do This Right Now and Prove You Can FIX TV TROUBLES YOURSELF

Turn your set around. You will find in the back of it an arrangement of "rear controls" looking like this:



Zags on Your Screen

Now, if you are troubled with these zags on your screen, locate Hor. Syn. on the above rear panel. Turn control slowly to left. Zags will disappear and you will have a perfect picture on your screen. That's all there is to it. You have made a $5 repair in less than 5 minutes.

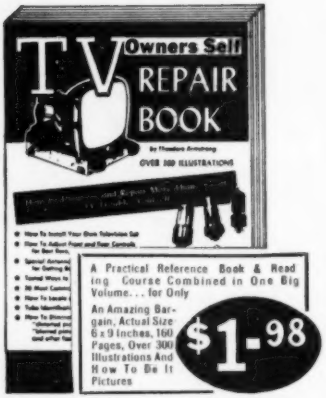
A few other repairs that you can make yourself without tools, without any special knowledge, just with the help of this new TV Owner's Self Repair Book.

6 Easy Ways to Eliminate Interference

In the TV Owner's Self Repair Book there is a unique chapter devoted just to elimination of interference. This chapter tells you just what "interference" actually is. It describes and illustrates the interference symptoms of patterns which appear on your screen in the form of diagonal lines, vertical lines, herringbone or hyphens all over the screen, etc. **This chapter gives you the easy ways to eliminate interference, doing it yourself in a few minutes.**

Complete Price Lists of All Tubes

The TV Owner's Self Repair Book contains a full listing of every tube used in TV sets, fully identified with number, and also listing of picture tubes and with the fair retail prices (by the way, prices range from $1.10 for a 5YEGT tube to **$6.60** for a 6CDG tube and up to $101.00 for a 24 inch picture tube, 24BF4). A full listing, also, of standard and reasonable charges for every type of television service and repair job. No longer need you be in the dark when it comes to knowing what a job should cost. Now you can make your own minor repairs and in addition know just how expensive "Expensive" repairs should really be.



Never Before Such a Complete Authoritative Book for So Little Money!

It contains chapters devoted to GETTING ACQUAINTED WITH YOUR TV SET, telling you how the set is put together, how to understand the controls, how to operate the set, why a "test" pattern is needed—and HOW A TV SET WORKS, telling you how pictures and sound are broadcast and received. Included in the broad scope of this book, is complete information on HOW TO DIAGNOSE TROUBLES IN YOUR TV SET, telling you how to spot faults due to poor adjustment, faults due to wear and breakdown of tubes and parts, faults due to outside causes including extreme distance from telecasting center; also HOW TO CURE YOUR TROUBLES IN THE SET, telling you with pictures and descriptions just how to go about replacing tubes, parts, HOW TO MAKE VARIOUS ADJUSTMENTS and how to do all this without the slightest danger to yourself or to your set! There is also a special chapter devoted to television accessories, such as boosters, what they do, Interference, Traps, Glare Filters, Antenna Couplers, which means a master antenna system which permits the operation of two sets from a single antenna, and much, much more.

Unconditional Money Back Guarantee!

Let us send you a copy of this TV Owner's Self Repair Book. Look at it, go through it, read the general information it offers on how a TV set works. Use it to adjust the controls on your set to 100% perfection. Use it, above all, in making your next "fix-it" job on your set. Then—if you don't think that it is the best book of its kind on the market, that it will save you up to a possible $300 on repairs and adjustments on your set during its life, return it to us. We'll promptly send your money back. You must be satisfied 100% or it costs you nothing to examine and try the book—in your home on your set. What could be fairer? But send for the book now and enjoy the best television reception from your set right away!

SEND NO MONEY unless you wish

M. Sears Industries, Inc., Dept. 651
799 Broadway, New York 3, N. Y.

Please send me the TV OWNER'S SELF REPAIR BOOK immediately. I agree to pay postman on arrival $1.98 plus C.O.D. postage. If the book does not help me get a clearer, sharper, better defined picture than I am now getting—if the book doesn't make it possible for me to fix or repair my own set, if I am not 100% satisfied, I may return the book for my full money back!

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650-16(6)	6.92	670-15	5.22	750-16	9.62	750-20(10)	17.52
700-16	6.52	710-15	5.72	750-15	13.22	825-20	18.22
700-16(6)	8.72	760-15	5.92	750-17	11.52	900-20	17.22
750-16	7.02	800-15	6.62	700-18	15.82	1000-20	18.52
525-18	4.92	820-15	6.72	600-20	8.72	1100-20	18.52
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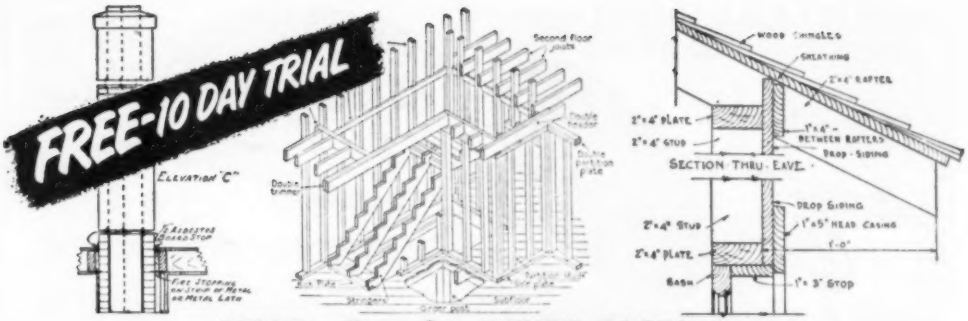

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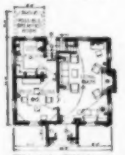
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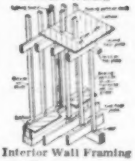
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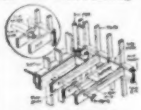
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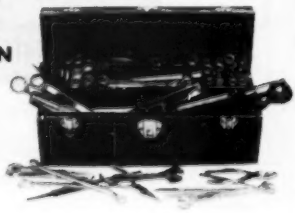

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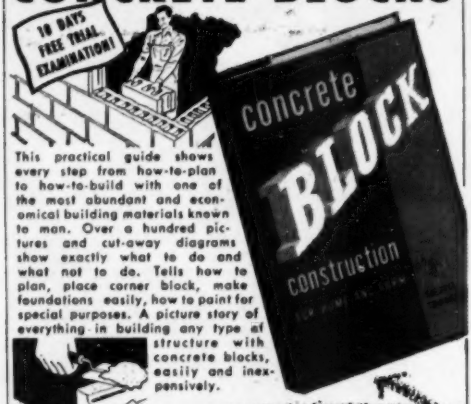

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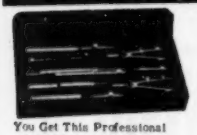

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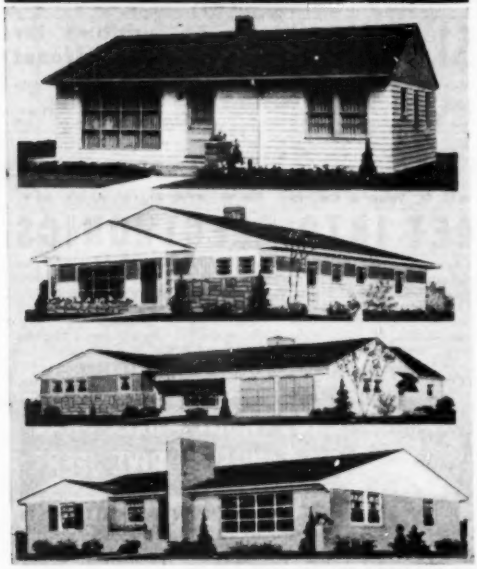

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700-16	6.45	760-15	6.05	750-15	13.95	900-20	17.25
750-16	9.25	800-15	6.55	825-15	12.95	1000-20	17.75
525-18	5.00	820-15	6.65	600-20	8.75	1100-20	19.55
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By F. G. Strong

I won't make any fancy promises of $50.00 a day. And I'm not after any of your money. What I can do is show you a simple plan by which you can pick up enough extra money every week to help make up for the money you're losing in higher taxes and higher costs of living. And I supply your working outfit free—no charge and no deposit. Just your name is all I need. Read my proposition. It is honest and down to earth. And it won't cost you anything to try it.

TODAY almost everyone needs extra money. Increased taxes and increased living costs are making your dollar worth less and less, so you have to have more and more dollars just to keep even. There are lots of good ways to make extra money. I don't say my way is the best. I do say it's one of the easiest and most pleasant. It even leads to making new friends in sort of an endless chain. It doesn't call for house-to-house canvassing either. Let me explain:

I am Sales Manager for a very big company. We make stainless Steel Cooking Utensils. We do an enormous business with hotels, restaurants, hospitals, and institutions. We also make utensils for the Army, Navy, and Air Force.

As a result, we have very low manufacturing costs. We can **sell** a set of Stainless Steel Cookware for home use for about what it costs some companies **to make it!** In fact, for years we did sell to one Sales Organization who resold our cookware house to house under their own name. They got $120.00 for the same set that our people sell for less than half of that.

You've probably heard of salesmen who give dinner parties in homes and then take orders from the ladies who attend. These salesmen have to get a high price because it costs money to give parties—he has to make his share—and his supervisor has to make his. The sales organization comes in for a share and the manufacturer who sells to them has to make his. So there are about five profits added to the actual manufacturing cost.

About two years ago I got to figuring. There are five good reasons why Stainless Steel is the kind of cookware that should be in every home. 1. It washes as easy as a drinking glass. No scouring, scraping or scrubbing. 2. It doesn't rust or corrode—and it doesn't stain. 3. It doesn't affect the taste of food. 4. Buy it once and you're all through buying for life. You **can't** wear it out.

You see, Stainless Steel is not a coated or plated metal, like chromium plate on the bumper of your car. That chromium plate can chip or wear off and exposes the raw steel underneath. Then the steel rusts. But our kind of Stainless Steel is stainless **all the way through.** It can't chip, crack, peel, or wear off. You could use a set the rest of your lifetime and then give it to your children and it would still be good for **their** children. 5. Carlton Ware enables you to prepare food by the method called "waterless cooking" which keeps more of the natural minerals and vitamins in your food and makes the food taste better.

Well, I figured that if the price was low enough every family could afford Stainless Steel Carlton Ware. So I worked out this plan! We would sell a complete set of 19 pieces at a figure that would include our profit. Then you add your profit and re-sell this set to your friends and neighbors for less than half of the usual price charged on the "party plan." You actually save them more than half. They are glad to get such a bargain and they feel that you've done them a real favor. That's because the set they buy has in it only two profits, ours and yours. Both our profit and your profit is small and fair.

The plan becomes like an endless chain. When a woman gets her first piece of Carlton Ware she gets so thrilled with its better cooking and easy cleaning that she talks and talks. She can't wait to demonstrate it to her friends and tell them all about it. She's so proud of its silvery sheen and so happy about how easily it washes that she just "bubbles over." So just by letting **your own friends** in on a good thing, before you know it **their** friends call you up and ask if you can get the same low prices for them. Then **their** friends call you and their **friends' friends.** It goes on and on!

To make an extra $125.00 a month, you only have to deliver ten sets and that's easy. Mrs. Montell in Pennsylvania took orders for $1400.00 worth in her first month. And Mrs. William Hanchow wrote, "Got my set Saturday—I already have 17 customers."

Now, I'll let you in on another part of my plan. If you take only ten set orders a month for six months my company pays your expenses for a winter vacation in Florida. You and one other member of your family can spend a whole week at our expense. My company maintains a beautiful resort in the Florida Keys just so our sales representatives can enjoy a Florida vacation at company expense.

Get all the information right now. I'll not only be glad to send Free Information. I'll also send you a complete demonstrating outfit that you can show to your friends and neighbors. And I'll give you exact instructions by which you can write up orders without ever trying to "sell" and without making any house-to-house calls.

Everything I send you is free. When you qualify, I'll even furnish you with a complete 19-piece set of Carlton Ware to use in your own kitchen and show to your friends. It's an extra bonus I give to encourage good earnings on your part.

Send your name today in confidence. You'll be glad you wrote. This ad may not appear in this magazine again, so don't take any chances on losing out. Send the coupon or just send your name on a postcard. I won't send any salesmen to call on you and you won't be under the slightest obligation.

F. G. STRONG

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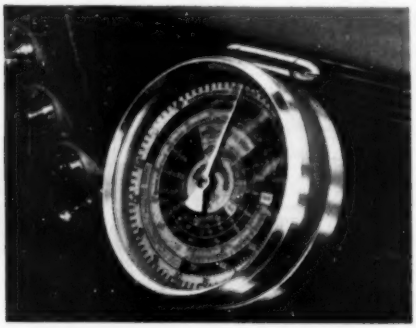

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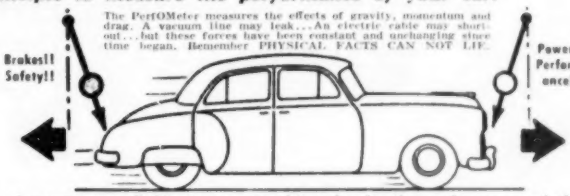

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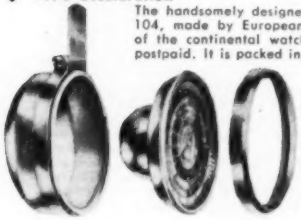

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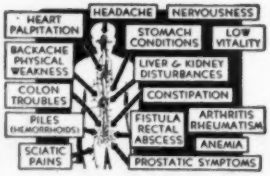

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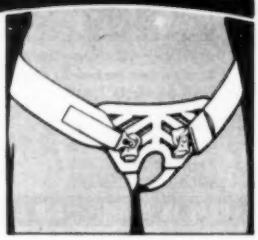

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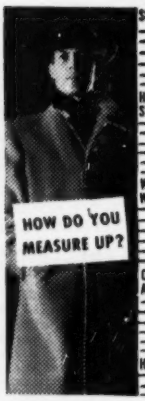

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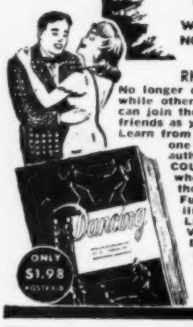

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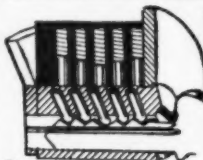

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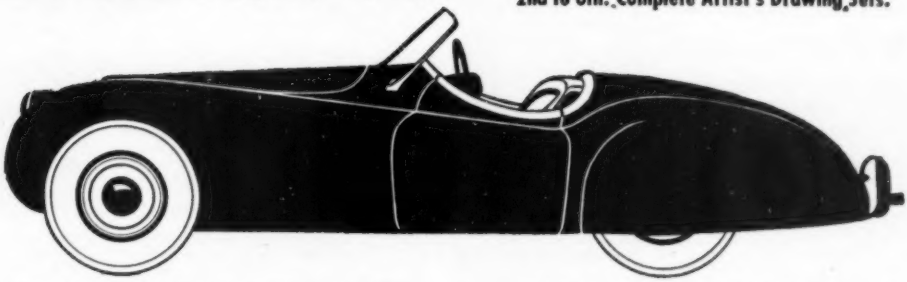

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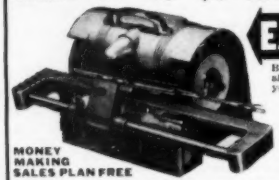

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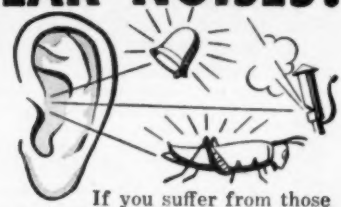

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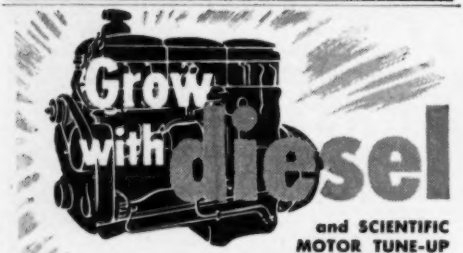

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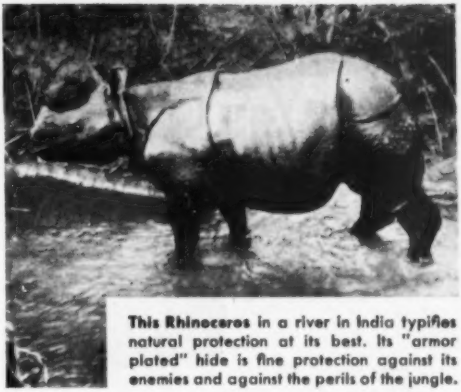

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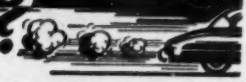

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GENUINE copper birthday cards, 50c seller, 6 assorted $1.00 sample 25c. L. Moran, 38-44 Waverly Ave., Seaford, Long Island, New York.

NEED Extra Cash?—Get it selling Blair's unusual line of household and food products. Every housewife a prospect. Send for samples Free. Write Blair, Dept. 55LB-1, Lynchburg, Va.

FREE literature describing money making plans. Hugh Zentz, Elkhart, Indiana.

MANUFACTURE Rhinestone and Pearl Jewelry at home. Latest creations, tremendous profits, no skill needed. Postcard brings illustrated catalog of settings, stones, etc. A. Y. Cutt Co., Inc., 210-H Fifth Ave., New York 10, New York.

PROFITABLE Hobby—Clipping Magazines! Information 3c. Croom, 403 Colley, Norfolk, Virginia.

$35 WEEKLY addressing envelopes. Instructions $1, refundable. Adservice, Spring Valley 36, New York.

WIN Cash, Cars in Prize Contests. Send 30c for winning hints, tips, Digest, Dept. 20-B, P. O. Box 2266, St. Louis 9, Mo.

WANTED: Typewriter owners. Make handsome profits. Write today. Groves Company, 682 Hastings 3, Nebraska.

LEARN Watch-Clock Repairing at Home. While learning we fix your watches—clocks—Special Bonus Offer—Inquire Modern Technical Supply, 55-PS West 42nd Street, New York 36.

EARN Money Evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 2, Wisconsin.

WIN contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minnesota.

LIVE Better—Live Happier—Find security, Profit In The Country. Interesting facts Free. Hermes Publishers. 152-D West 42nd Street, New York.

EARN While You Learn Make Your Mirrors—Silvered Glass ornaments. Bottles, etc. Big profits—Good Hobby—Detailed illustrated course includes Trade Formulas—Only $1.50. Illustrated Co., 176 San Fernando Rd., Los Angeles, Calif.

MAKE to $4.50 hour doing common pen lettering. National Artists. 801 North Marsalis. C-5, Dallas 3, Texas.

SPARE-Time Investigators! Eight big money-makers. Everything complete. $5. Jasper. PS-1. Box 17. Monroe, Louisiana.

EARN money spare time. Free Particulars. Chamberlin, Box 894, Manchester, New Hampshire.

FREE Book "505 Odd Successful Businesses." Work Home! Expect something Odd! Pacific-35C, Oceanside, Calif.

FREE Booklet reveals amazing secrets behind 301 new profitable enterprises! Many mailorder! Includes confidential instructions for starting wholesale buying service. Deumant Publications, 83-T Deumant, Kenmore 23, New York.

MAIL Order Business, Giftware—Home Products. Free advertising method. Unlimited opportunity. Write H. O. Seidel, 7070 Hollywood Blvd., Hollywood 28, Calif.

PROSPERITY in 1953 details 25c. John Earhart, RFD 5, Lancaster, Penna.

A $100-A-Month hobby at home! No soliciting, no mail order, no meeting people. Easy enjoyable pastime. Details 25c (Refundable). Laura Dickson, 401 Montague St., Anderson, South Carolina.

MAKE Money and rid living room of scattered newspapers. Send 50 cents for plan W-521, Watson's Canton, New York.

$$$ IN Personalized Baby Record Books. Sell By Mail Use Same Literature We Do. No-Co-Ro, Oakland 6-P, Calif.

JUNK Pays Big money—Know How, Where, Get, Buy, Sell Scrap. Send $2.00. Aztec Supply, Rock Island, Illinois.

39 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Ill.

GET $1.00-$2.00 Orders By Mail—Keep every cent. Everything furnished. Write Alliance Sales, 568-A, Alliance, Nebraska.

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FREE Formula Catalog. Anything analyzed $35.00. Western Chemical, Salem, Ore.

CHEMICAL Formulary—9 volume authority! Thousands commercial manufacturing formulae. $7.50 any volume. $63.00 complete! Also, book 10,000 formulas, $3.98. Literature. Paullin, 1095B, Loudonville, Ohio.

LABORATORY tested formulas. Lists Free. Pont, Box 635-PS, Terre Haute, Ind.

ANY Formula $3.00. Chemical Instruction Sheet—catalog 10c. J. Belfort, 216 W. Jackson, Chicago 6.

40 PLASTICS

PLASTICS home-craft course for Men and Women. Tells and shows how to make hundreds of fast selling plastics products. All plastics and materials for 23 projects included in course. No special tools needed. Course pays for itself. Write for Free booklet. Interstate Training Service, Dept. D-2B, Portland 13, Oregon.

PLASTIC Sheets, Rods, Tubes, etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

MAKE Plastics. Simple instructions, formulas. $1.00. Materials readily available. Lab. Box 232, A. St., Cashmere, Wash.

LEARN Plastics at home. Small cost—Spare time. Dime brings sample plastic, three experiments, full details. Plastic Projects, Box 5151, Detroit 35, Mich.

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NEW liquid casting plastic. Clear, colors. Embed flowers, insects, coins. Saw, drill, carve. Send 25c for Castolite Creations Manual and proved Success Plan showing how to make money at home. Castolite, Dept. B-102, Woodstock, Illinois.

LUCITE, Plexiglas. Any size sheets masked Square foot (12 x 12) cost 1/16" $1.20; 1/8" $1.40; 3/16" $1.75; 1/4" $2.08. Include 10% postage. Almac Plastics, 600 Broadway, N. Y. C.

PLASTIC sealing photos, cards, wallet size 25c. Sample Free. 620-A St. Ann's, New York 55.

PLASTICS, Lucite, Plexiglas, Acetates, Polyester-Fiberglas. Compare our retail-wholesale prices. Be sure you get our new value-packed, bargain-filled catalog—10c. Airmailed—35c. Gem-O'-Lite, Box 6861Z, North Hollywood, California.

NEW Engraving, Carving Attachment for hand motor tools. Details, plastic sample 25c. Profits unlimited carving plastics. Desco Distr's., 6334-H Sepulveda, Van Nuys, Calif.

41 CHEMICALS & APPARATUS

LABORATORY Apparatus, Chemicals, Microscopes. Complete Chemistry Sets, Minerals, Uranium Ore, 10c brings catalog. Porter Chemical Company, Hagerstown 2, Maryland.

NEW Idea Chemical and Apparatus Outfits for Home Experimenting Photo-Scales, Microscopes, Chemicals, Biological and Laboratory, Supplies in Small Quantities. Catalog 25c. Established 1931. John H. Winn, 124-B West 23rd Street, New York, N.Y.

LUMINOUS Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

SPECTROSCOPE for quick chemical analysis $3.00. Cutting Sons, Los Altos, Calif.

NEW Chemical Supply Catalog, 15c, refundable. Laboratory Sales, Box 161-B, Brighton, Mass.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology, 10c. Tracey Laboratories, Evanston, Illinois.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 20c. Dept. M-26. Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

SECOND Printing. Improved version, spectacular chemical fireworks experiments manual. Contains complete setups, formulas, instructions on thermits, fulminates, powders. Still $1.00 postpaid. Chemi-Technix Laboratories, 568RP Riley, Buffalo 8, New York.

42 HELP WANTED

FOREIGN & Latin American Employment 1953 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters, How-When-Where to apply, application forms, Hot List Firms Hiring. $1.00 postpaid. Global Reports, Box 883-S, Hollywood 28, Calif.

CONSTRUCTION Job List. Published Monthly. $1.00. Dempster's Construction Scout News, Dept. 268-DY, Bridgeport, Ill.

WANT To Make More Money? Have a real career with a lifetime of high salaries? I'll show you how to succeed in the growing automotive-diesel field. Write Ed Howes, Chief, Dept. 523, 4000 S. Figueroa St., Los Angeles 37. No obligation.

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$1,000,000 FOREIGN & Domestic Construction Projects published Monthly, gives Contractor & Locale, How-When-Where to apply with application form. $1.00 postpaid. Global Reports, Box 883-PX, Hollywood 28, Calif.

ALASKA!! Last American Frontier. $1.00 brings 1953 Business Directory & Government Map, Military & Civilian Construction; Homestead & Highway facts; Mining, Aviation, Fur Farming, Grazing, Timber, Travel directions. List of firms hiring. How to apply. Alaska Opportunist, Box 92 Hollywood 28, Calif.

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FOREIGN Employment Construction men, building trades, helpers, office men, others, interested in Foreign Projects. High wages, quarters, transportation. Send $1 for Foreign Construction Compendium and Application Forms. Foreign Service Bureau, Dept. PS-2, Metuchen, New Jersey. (Not an employment Agency—no fees.)

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CANADA's boom creates jobs, send $1.00 for "Construction & Oil Worker's Monthly Bulletin" listing Construction projects & oil Drilling Contractors. National Surveys, Box 402, Vancouver, B.C., Canada.

43 AGENTS WANTED

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide. Listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 18, Chicago 4, Illinois.

START Your Own Business on credit. "our own boss. 1586 of our Dealers sold $5,000 to $27,500 in 1951. We supply stocks, equipment on credit, 200 home necessities. Sales experience unnecessary. Pleasant, profitable business backed by world-wide industry. Write Rawleighs, Dept. B-U-PSC, Freeport, Ill

BIG profits selling ties ($2.00 values) $6.50 dozen. Free catalog. Empire Cravats, 648A Broadway, New York 12.

GOLD Lacquered and silver sign letters, Windows, doors, trucks. Standard Sizes. Penny and up. Samples. Atlas-G, 544 West 79th, Chicago 20.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 431-E North Clark, Chicago.

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BUY Wholesale—25,000 items—Catalog 25c. Matthews, 1472-A5 Broadway, New York City 36.

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BOYS or Girls, Men or Women: Earn large cash commissions, or valuable merchandise selling Garden Spot Seeds. Send No Money, just name and address, receive 50 packets of seed to sell at 10c packet, and Free 24 page Catalog. Lancaster County Seed Company, Dept. 413, Paradise, Penna.

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LADIES! Need clothes and money? Easy to take dress orders. Big commissions in advance. Beautiful Style Presentation Absolutely Free! Send no money. Melville Co., Dept. 7929, Cincinnati 25, Ohio.

ANYONE Can Sell Hoover DuPont Nylon Uniforms for beauty shops, waitresses, doctors, nurses, others. In white and colors. Exclusive styles. Top quality. Low priced. Exceptional income. Real future. Equipment free. Write fully. Hoover, Dept. J-101, New York 11, New York.

MAKE Money with fast-selling Bostonian Shirts, Blouses too. Spare time, full time. Sales Kit Free. Bostonian, 89 Bickford, Dept. U-11, Boston 30, Mass.

BONUS Suit Plus Big Profits! Sell made-to-measure men's clothes. Fit satisfaction guaranteed. Big values sell fast. Profits to $11.50 per suit. Sample Outfit Free! O. K. Tailoring, 325 S. Market, Dept. 169, Chicago, Illinois.

EXTRA Money showing home decal decorations. Exciting beauty, color, new personality for every room. Free Samples plus two complete assortments on approval. Write Decal-Art, 344 Lorel Ave., Dept. B-107, Chicago 44.

FAST sellers. Big demand. Catalog. Parker Drug Co., Hoboken 6, New Jersey.

AMAZING discovery. Master Glaze puts brilliant glass-like surface on cars. Free sample information. Big commissions. Master Glaze, Dept. 763, 7720 Harwood, Milwaukee, Wisconsin.

CALENDARS, Advertising Novelties, Matches. All styles, including Religious, Varnished. 12 sheet. Girls. Hundreds of Advertising Novelties. Book Matches, etc. Fleming Calendar Co., Promotional Division, 6539 Cottage Grove, Chicago 37, Ill.

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$10-$10-$10-$10-$10-$10, MAKE $10 And More daily by supplying friends, neighbors and relatives with wonderful, new variety of Elmira All-Occasion Greeting Cards, Personalized Stationery, Imprinted Napkins, gift wrappings and lovely gift bargains. Free Catalog. Samples on approval. Bonus. Fast Service. Ideal for Church and Club Funds too. Write today. Elmira Greeting Card Co., Elmira 28, N. Y.

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A Postcard Can Put You In A Fine Business! Complete line. Leather jackets, 151 shoe styles. Big commissions. No experience, no investment. Send postcard for Free outfit. Consolidated Shoe, Dept. CC-21, Chippewa Falls, Wisc.

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46 CONTESTS

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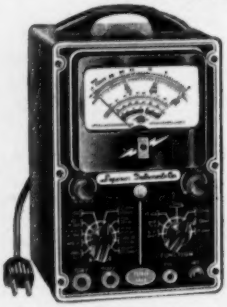

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D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes.

RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms

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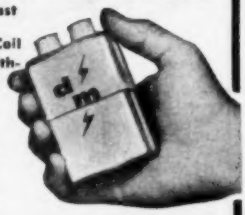

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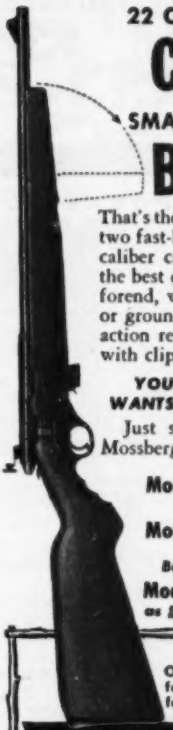

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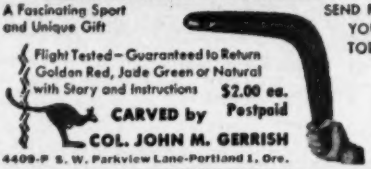

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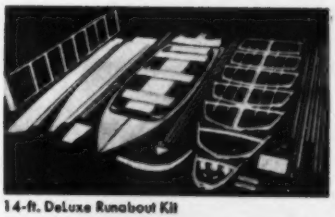

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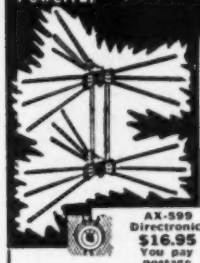

Rocket DIRECTRONIC MOTORLESS TV ANTENNA

360° Electronically Switched Beam

- No Motors
- No Roof Orientation
- No Electric Power
- No Ghosts
- Flick of Switch Clears Picture Instantly

In the city or in a fringe area, the Directronic will out-perform ordinary antennas. Only the Motorless 360° Directronic TV Antenna offers "around the compass" reception WITHOUT Rotors. Clarity of picture will amaze. It's so bright, so sharply defined. AX-599 "Serviceman's Array" contains Hi-Pac molded insulator of extremely high tensile strength, 18 hi-tensile aluminum alloy elements, 1 set of connecting stubs (3), Universal U-Clamps for masts to 1½", Directronic Beam Selector, 75 feet of Tri-X Cable.

AX-599 Directronic $16.95 You pay postage

Do not remit more than complete purchase price. 25% deposit on C.O.D. orders, please. Money-back guarantee.

NATIONAL ELECTRONICS OF CLEVELAND
402 DELCO BLDG. CLEVELAND 3, OHIO

ROOKIE HITS JACKPOT WITH THE *HAWAIIAN WIGGLER #2*

R. B. Jacobs of Baytown, Tex., had never tried bait-casting before, but it didn't take him long to get convinced when he took this fine string of bass on his first attempt. The fishing spot was a lake on the White River (Arkansas) and the bait was the Hawaiian Wiggler No. 2. You can't beat the old No. 2 around pads, brush, stumps and logs. Live-looking rubber Hula Skirt. Spinning and light tackle size (1/4 oz.) or casting size (5/8 oz.)—each $1.15.

SHALLOW RUNNER

MORE FLASH MORE ACTION MORE FISH!

WON'T HANG UP

Choice 4 Colors

FREE WRITE TODAY FOR YOUR BIG FREE ARBOGAST COLOR CATALOG OF BAITS—FULL OF PICTURES OF CATCHES

FRED ARBOGAST & co., INC.
2322 WEST NORTH STREET • AKRON 3, OHIO

"What a beaut! Must be that new Scott-Atwater Gold Pennant motor*!"

WRITE FOR FREE FOLDER!

Read all about the sensationally new Gold Pennant outboards. New in styling! New in features! New in performance! Write to: Dept. P-23, Scott-Atwater Mfg. Co., Inc., Minneapolis 13, Minn.

*7½ and 10 HP with Shift, "Stowaway" Tank, Twist Grip Speed Control

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MAKE RIFLE FURNITURE!

Remington *Rolling Block Rifle*

Authentic 1869 Model .43 Cal. $9.95

FREE PLANS! 6 sets of working plans for making useful unusual furniture included with rifle.

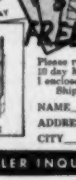
Unbelievable but true! This famous "rifle of the past"—long a collectors' treasure—is yours for only $9.95! Make it into useful, distinctive furniture for your home. Or mount rifle "as is" over fireplace...in den. A real money-making opportunity, too! Make "romantic" lamps, bookcases, ash tray stands. Earn $5-$10 an hour! Sell to friends, sportsmen, clubs, stores, even mail order. Our successful "Business Getting Plan"—free with rifle—tells how to sell quickly! Order one or more rifles now.

10 DAY MONEY BACK GUARANTEE!

FREE HISTORY! A RIFLE OF THE PAST—WITH A PAST

Relate the story of this famous rifle to all who admire your "rifle-furniture"! Once the world's most famous rifle. Adopted by 9 governments. Action unequalled for strength. Can be rebarreled to .45/70, other calibers. Wt. 9½ lbs. Length, 50½" Barrel, 35". Good condition.

INCLUDED WITH RIFLE (no extra charge)
1. Set of 6 Working Plans.
2. Tested "Business Getting Plan".
3. History of Rolling Block Rifle.



CLIP AND MAIL TODAY!

WINFIELD ARMS CORP., Room PR-2
490 East Pico Boulevard, Los Angeles 15, California

Please rush me _____ Rolling Block Rifles at $9.95 each, under 10 day Money Back Guarantee. Include FREE Plans & History. I enclose $_____ (Send check or money order.)
Shipped Express Collect. C.O.D.'s, $5 Deposit Per Rifle.

NAME _____
ADDRESS _____ ZONE _____
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DEALER INQUIRIES INVITED WRITE TODAY!

Made stronger to last longer

E&J FOLDING WHEEL CHAIRS

- Easy handling
- Comfortable
- All welded joints
- Chrome plated
- Accessories and modifications available

See your dealer or write for catalog

EVEREST & JENNINGS

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AUTO-SHOCKO Have some REAL FUN with your car. With AUTO SHOCKO you can give anyone who touches the outside surface of your car a HARMLESS but VERY EFFECTIVE shock. When the AUTO SHOCKO switch is on, the entire outer surface of the car becomes charged. You can also charge your buddy's car by touching your bumper to his. Then he won't be able to get into his car until you turn off your switch. Can also be left on while car is parked to keep vandals from scratching or damaging your car. Will not run down your battery. AUTO SHOCKO is probably the best FUN MAKER you will ever own. Easily installed in a few minutes. Sent complete with AUTO SHOCKO unit, wire, switch, etc. Price $9.95 ppd., or COD plus postage. $1 deposit required on COD orders.

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Largest supply in New England. Fittings — Blueprints — Books. All prices. Write Dept. PS53. BIG ILLUSTRATED CATALOG 25c

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HUNDREDS OF BARGAINS!

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DEPT. I 11010 VICTORY BLVD., NO. HOLLYWOOD, CALIF.

CABLE PLANE

Fully self-propelled. Offers thrill of flight. Safe. Endless possibilities for multiple installations. Travels in either direction—turns at will. Could be coin-operated. Have full-sized working model. Could use overhead rail. Patented. Will sell. Write

DON GRAZIER, *Inventor*
DIXON, MONTANA

KEEP YOUR BEARINGS ON TWISTING HIGHWAYS

A HULL AUTO COMPASS immediately sets you straight, after spinning through modern traffic circles and cloverleaf gateways. It's one of the countless occasions you'll check your HULL for directions. Write for local dealer's name, free literature.

MORE HULLS IN USE THAN ALL OTHERS COMBINED

HULL MFG. CO.
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not everyone does as well, but E. O. Lockin, who started a business of his own, reports...

for 12 months I've averaged $800 PER MONTH INCOME —most of it clear profit for me!

• Mr. Lockin expresses his grateful thanks for the opportunity to make a decent living on his own. Many men have discovered how to be independent, to be freed of bosses and layoffs—to build their own future on a steady, dependable foundation. L. A. Eagles grossed more than $200 his first week. R. E. Traynor says, "*I made $62 gross in one day.*" Others report gross from $100 per week to $12,000 per year.

How much you make depends largely on *you*. You need no special skill, no large investment to start.

No shop necessary. Our ELECTRIC RUG WASHER cleans rugs and carpets like new right on the floor ...removes dirt and grime and helps to show their natural color and beauty. So efficient and safe for carpets, it is used by largest hotels and railroads.

You take no risk. Machines fully guaranteed. Mail coupon today for complete information including how to start making big profits quickly in YOUR OWN business. BIG opportunity. Send coupon now.

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You, too, can start your own business. No special skill, no large investment required. Costs nothing to find out—no obligation. Mail coupon today for interesting FREE book.

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Send at once (no obligation) your FREE booklet containing information about your ELECTRIC RUG WASHER and how I can start *my own* permanent, profitable business.

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GIANT BALLOONS

BIG fun for all! BIG boosters for BUSINESS! Genuine gov't. surplus weather & target balloons. Lots of fun in backyard, for parties, picnics, dances, fairs, etc. Sure to attract a crowd for business events, conventions, exhibitions, trade shows. Used by lodges, civic groups, schools from coast to coast. These are terrific attention getters! Send for your GIANT BALLOONS today.

3 Ft. Dia. 49c—6 Ft. Dia. 79c —13 Ft. Dia. $1.59

• *Add 10% for handling & postage. Calif. res. please add sales tax.*

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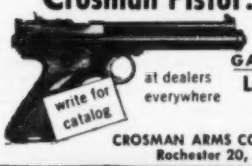
Crosman Pistol...for accuracy



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GAS POWERED
Low Cost Shooting
indoors or out

CROSMAN ARMS CO., Dept. 46
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more fishing fun!

LESS MAINTENANCE ...

STARCRAFT

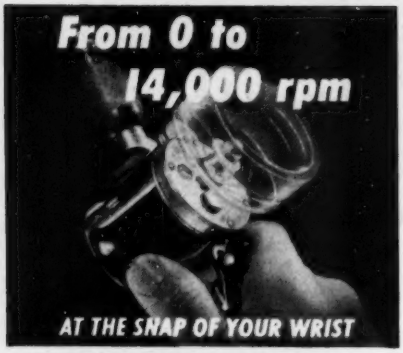
ENJOY years of fishing in a safe, easy-to-handle *Starcraft Boat.* Rugged, lightweight construction of *magnesium, aluminum, stainless or galvanized steel.* Low prices. Every desirable feature. Write for free catalog today. Dept. DD-2.

STAR METAL BOAT CO. • GOSHEN, IND.

For Discriminating Users

Scientists, explorers and engineers choose Burgess Batteries where lives depend on battery power, because they are recognized as best by the experts. Insist on using Burgess Batteries in your flashlight. Burgess Battery Company, Freeport, Ill.; Niagara Falls, Can.

A Quality Dry Battery For Every Purpose



with a **PFLUEGER REEL**

Ever think how fast a bait travels through the air? Shooting out 80 to 100 feet in two seconds means peak speeds up to 40 miles per hour. And the spool that feeds out line turns up to 14,000 revolutions per minute!

Pflueger Reels are built to last—by the third generation of trained craftsmen. Pflueger Reels, from $2.10 to $35.00, mean better fishing. Ask your dealer.

THE ENTERPRISE MFG. CO., AKRON, OHIO
88 years making fishing tackle

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(Pronounced "FLEW GER")
A GREAT NAME IN TACKLE

Do you work all day with

COLD FEET?

NOW,

at last, a new, modern, low priced electric foot warmer that will keep you healthy, happy and comfortable

Help prevent colds with...
ELECTRO MAT

Check stand cashiers, secretaries, assembly line workers, housewives, office workers, theatre cashiers, machine operators, telephone operators, and many others throughout the country are now singing the praises of the Electro Mat. There is no further need to work all day with cold feet. Many colds, causing absenteeism and irritability, can be directly traced to cold feet.

Be Comfortable, Happy and Healthy on Your Job During Cold Winter Months.

Consumes less power than a 75 watt light Bulb.

Mail your check or money order today for ONLY

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F.O.B. Factory

Send for your light-weight, portable Electro Mat today. Made of Quality Neoprene Rubber, Size 14" x 21".

You will agree it is the best investment you have ever made.

Safe and Economical

PETERSON RUBBER MAT CO.
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SPATZ PISTOL INVENTION!

$2.98 full price
Complete with 50 bullets postpaid

Simplified percussion action

Permits low cost shooting. Not an air or CO^2 gun. Light 16 mg powder charge shoots .12 caliber lead bullets. Works like cap pistol . . . has only 4 moving parts. 5 inch barrel. Free pamphlet on expert target shooting, indoor-outdoor target ranges. Ammunition at stores. Limited quantity Spatz pistols. Sold direct only. Adults only. Send $2.98 to LUNDE ARMS CORPORATION, BOX F 54, ALHAMBRA, CALIFORNIA

NEW BOW DEVELOPMENT! $12.95 post paid

faster - smoother - more accurate

OUT-SHOOT $30 BOWS! Hunting, target. Scientifically designed by a large manufacturer to give uniform perfection at low cost. Extreme durability—won't split. Rawhide bound leather grip. Unusual bargain. Limited quantity.

Superior to any known wood. Light spring aluminum steel alloy gives extraordinary thrust. Unusually flat trajectory gives you more accuracy. Registered 50 lb. pull. Efficient recurve tips. Professional bow.

MONEY BACK IF NOT SATISFIED. Send 12.95 to TECHRITE CORP, Box 12L, South Pasadena, Calif.

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Plastic Vinyl **$6.75**

USE IT ANYWHERE

• Folds compactly • Keeps rain, snow, dust, salt air, sun or sleet away • Protects your car's finish • Durably constructed of vinyl plastic • Springtite elasticized bottom, holds securely in all kinds of weather • Fits all makes • Direct from manufacturer • Enclose check or money order for 6.75, or sent C.O.D. 10-day Money Back Guarantee. MARDO SALES CORP., 480 Lexington Ave., Dept. G-682, New York 17, N.Y.

BOAT KITS

12 ft. model pictured

- Use simple tools to assemble
- Step-by-step instructions
- Precision pre-shaped parts
- One-piece plywood planking
- Screws, paint included

New Catalog of all models 10c

Marine hardware & complete accessories

LUGER INDUSTRIES Marine Division 3207 FREMONT AVE. SO. MINNEAPOLIS 8, MINN.

ELECTRICITY *Anywhere*

FOR PORTABLE, EMERGENCY OR HOME USE

ONAN Electric Plants generate 110-volt, 60-cycle current for homes, farms, cabins and resorts beyond the highline. Lightweight, portable plants cut costs, speed work for contractors. Standby plants protect hospitals, homes, civil defense units against power failure. 400 to 55,000 watts. Gasoline or Diesel-powered. Priced from $219.00.

WRITE FOR CATALOG

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Your guardians of quality in radio, television and recorded music

When you see these trade marks on television sets, radios, "Victrola" phonographs, and other electronic instruments you are assured the highest quality—born of research, fine engineering and craftsmanship.

The sun never sets on these trade marks, and millions of people around the world turn to them with friendly confidence.

RCA, as the pioneer, continues to lead in every major advance . . . in all phases of TV.

RCA Victor has made radio a household word to millions. "Victrola" phonographs have moved music from concert halls to homes . . . from Broadway to Every Street, U.S.A.

You also see these trade marks on records so rich in "living presence" that artists seem to be performing in your home.

Little Nipper and the familiar phrase "His Master's Voice" have appeared on recordings made by the greatest artists in the world—for more than half a century . . .

These same high standards of quality make NBC the nation's leader in radio and television broadcasting. You can depend on RCA and RCA Victor trade marks as *guardians of quality*—the sure guides to finer performance, greater dependability, better value and service.

Tmks. ®

RCA

RADIO CORPORATION OF AMERICA

World leader in radio—first in television

FOR 1953...

A New KING-SIZE Value

IN OUTBOARD MOTORS

Johnson Sea-Horse 10

$275.00 F. O. B. FACTORY

Johnson presents a new king-size value to outboard motoring — the brilliant Sea-Horse 10, WITH Gear Shift, WITH Mile-Master Fuel Tank, WITH Synchro Twist-Grip Speed Control, AND specially engineered for Johnson's new Ship-Master Remote Control. Here is power to breathe new life into your boat—the last word in fine outboard engines. All at a price that only Johnson's outstanding production makes possible . . .

FOR 1953 — FOUR GREAT ALTERNATE FIRING TWINS

SEA-HORSE 3—3 H.P. Only 31 lbs.! Amazing Angle-matic Drive. Goes where others dare not venture! **$145.00***

SEA-HORSE 5—5 H.P. Neutral Clutch. No shear pin. World's biggest seller! **187.50***

SEA-HORSE 10—10 H.P. Gear Shift. Mile-Master. Synchro Twist-Grip Speed Control. Brilliant acceleration! **275.00***

SEA-HORSE 25—25 H.P. Gear Shift. Mile-Master. Synchro Twist-Grip Speed Control. Speeds over 30 mph! **390.00***

All hp ratings OBC Certified brake hp at 4000 rpm.
**All prices f.o.b. factory, subject to change without notice.*

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SEA-HORSES
FOR DEPENDABILITY

Free Catalog: Full details on the 4 great Sea-Horses for 1953. Send for it! . . . See your Johnson dealer. Look for his name under "Outboard Motors" in your classified phone book.

JOHNSON MOTORS, 500 Pershing Road, Waukegan, Ill.
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THE ONLY MANUFACTURER WHO HAS BUILT A MILLION OUTBOARD MOTORS

ONE MILLION

BETTER PRODUCTION FACILITIES ...BETTER VALUE

POPULAR SCIENCE
REG. U. S. PAT. OFF. Monthly

Cars in the News

CADILLAC boasts the highest horsepower plus optional air conditioning for hot summer weather.

AS DETROIT'S annual automobile fashion show hit its peak last month, seven more manufacturers unveiled their 1953 models.

Four are pictured in full color on these pages. The others are described elsewhere in this issue.

The Studebaker is unique. It's the only car in the world with *mechanical* power steering.

The all-new automobile at the right is Hudson's entry in the Ford-Chevrolet-Plymouth price class. Called the Hudson Jet, it seats six. It will be obtainable with an aluminum head and twin carburetors that increase horsepower. It's no poor re-

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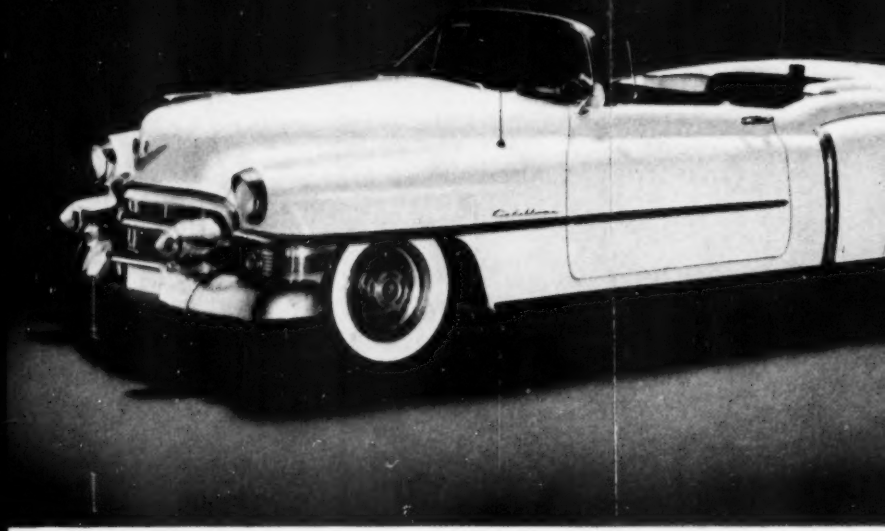
STUDEBAKER for '
low, sloping-hood conti
Clutches control the pow

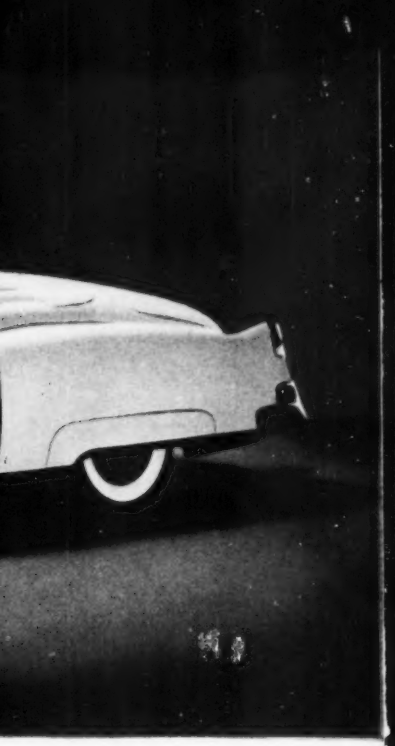
for '53 has that
ontinental look.
power steering.

HUDSON unveils the new Jet, a 2,800-pounder of less weight per horsepower than any other low-price car.



CADILLAC boasts the highest horsepower plus optional air conditioning for hot summer weather.

NASH goes fart
ings now. A new fro
sion gives a much s



farther between fuel-
w front-end coil suspen-
ıch softer ride.

lation to the other cars in the Hudson line—it develops more than 100 horsepower and with the special head has a compression ratio of 8 to 1.

Hudson also offers the Hornet, top money winner in stock-car races, the Wasp and a new Super Wasp. An aluminum head is standard on the Hornet, optional on the Wasp and Super Wasp.

The Cadillac is unique in its way, too. It's the world's most powerful motor car in mass production: 210 horsepower. The Lincoln—described in January—and Cadillac are in a nose-and-head race for top horsepower. A number of changes have gone into the improvement of the Cadillac engine. Its compression ratio is up from 7.5 to 1 to 8.25. Both valve timing and "lift," together with the shape of the combustion chamber, are modified.

Nash isn't lagging when it comes to horsepower, either. Its new Ambassador and Statesman have moved into fresh company. The Statesman is up from 88 to 100 horsepower. More miles per gallon come from a higher compression ratio and a four-barrel carburetor. The car is zippier on acceleration and has oomph for passing. For the Ambassador, an optional special engine adds 20 horsepower to the standard 120. It offers power steering, too.

NASH goes farther between fuelings now. A new front-end coil suspension gives a much softer ride.

lation to the other cars in the Hudson line—it develops more than 100 horsepower and with the special head has a compression ratio of 8 to 1.

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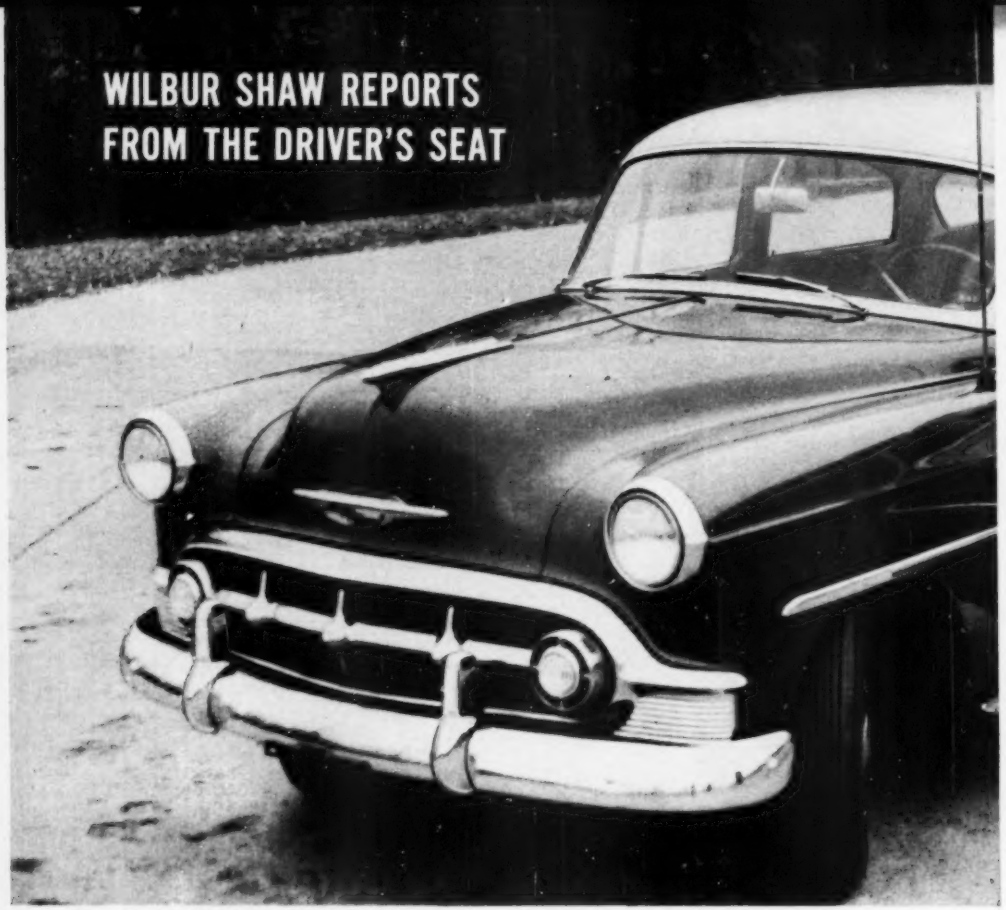
HERE'S YOUR Check List OF 1953 CARS

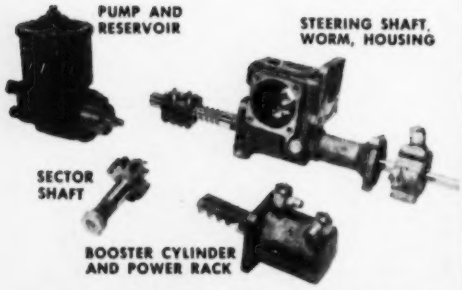
MAKE & MODEL (4-dr. sedan unless otherwise specified)	OVERDRIVE	AUTOMATIC TRANSMISSION	POWER BRAKES	POWER STEERING	AIR CONDITIONING	HORSEPOWER	CURB WEIGHT	WEIGHT PER HP.	TYPE OF ENGINE	VALVE ARRANGEMENT	BORE AND STROKE	PISTON DISPLACEMENT (Cubic Inches)	COMPRESSION RATIO (:1)	PISTON TRAVEL (feet per mile)	STEERING RATIO (:1)	WHEELBASE	FUEL	PICTURES AND FURTHER DETAILS IN POPULAR SCIENCE MONTHLY
BUICK Roadmaster		√	√	√	√	188	4,089	21.75	V-8	OHV	4 x 3-13/64	322	8.5	1,396a	21.3p	125.5	Prem.	Feb. '53
CADILLAC 62		√†	√	√	√	210	4,364	20.8	V-8	OHV	3-13/16 x 3-5/8	331	8.25	1,328a	25.4p	126	Prem.	Feb. '53
CHEVROLET Bel Air		√		√		115	3,515	30.5	6	OHV	3-9/16 x 3-15/16	235	7.5	1,742a	17.4p	115	Reg.	Feb. '53
CHEVROLET Standard						108	3,250	30	6	OHV	3-9/16 x 3-15/16	235	7.1	1,816	19.4	115	Reg.	Feb. '53
CHRYSLER Custom Imp.		√†	√	√	√	180	4,425	24.58	V-8	OHV	3-13/16 x 3-5/8	331.1	7.5	1,573a	16.2p	133.5	Reg.	Nov. '52
DE SOTO 8	√	√	√	√	√	160	3,705	23.15	V-8	OHV	3-5/8 x 3-11/32	276.1	7.1	1,463a	16.2p	125.5	Reg.	Dec. '52
DODGE Coronet 8*	√	√				140	3,530	25.2	V-8	OHV	3-7/16 x 3-1/4	241.4	7.1	1,408a	22.2	119	Reg.	Nov. '52
FORD 8	√	√				110	3,193s	29	V-8	L-head	3-7/32 x 3-3/4	239.4	7.2	1,558a	26.3	115	Reg.	Jan. '53
FORD 6	√	√				101	3,115s	30.8	6	OHV	3-9/16 x 3-39/64	215.3	7	1,762	26.3	115	Reg.	Jan. '53
HENRY J Corsair (2-dr.)	√					80	2,556	31.9	6	L-head	3-1/8 x 3-1/2	161	7	1,890	24	100	Reg.	Nov. '52
HUDSON Hornet	√	√				145	3,750	25.8	6	L-head	3-13/16 x 4-1/2	308	7.2	1,690a	25.6	124	Reg.	Feb. '53
KAISER	√	√				118	3,220	28	6	L-head	3-5/16 x 4-3/8	226.2	7.3	1,915a	25	118.5	Reg.	Nov. '52
LINCOLN Cosmopolitan		√	√	√		205	4,262	20.79	V-8	OHV	3-13/16 x 3-1/2	317.5	8	1,379a	21.3p	123	Prem.	Jan. '53
MERCURY	√	√				125	3,485s	27	V-8	L-head	3-7/32 x 4	255.4	7.2	1,624a	26.4	118	Reg.	Jan. '53
NASH Ambassador	√	√		√		120	3,525	29.4	6	OHV	3-1/2 x 4-3/8	252.6	7.3	1,668a	20p	121.25	Reg.	Feb. '53
OLDSMOBILE Super 88		√	√	√	√	165	3,704	22.45	V-8	OHV	3-3/4 x 3-7/16	303.7	8	1,329a	21.3p	120	Prem.	Feb. '53
PACKARD Patrician		√†	√	√		175	4,125	23.6	8	L-head	3-1/2 x 4-1/4	327	7.8	1,795a	22.5p	127	Prem.	Dec. '52
PLYMOUTH	√					100	3,170	31.7	6	L-head	3-1/4 x 4-3/8	217.8	7.1	2,040	21.1	114	Reg.	Dec. '52
PONTIAC 8		√		√		122	3,596	29.4	8	L-head	3-3/8 x 3-3/4	268.4	7.7	1,418a	26p	122	Prem.	Jan. '53
STUDEBAKER Commander	√	√		√		120	3,306	27.5	V-8	OHV	3-3/8 x 3-1/4	232.6	7.5	1,417a	20p	116.5	Reg.	Feb. '53
WILLYS Aero Lark	√					75	2,847s	37.9	6	F-head	3-1/8 x 3-1/2	161	6.9	2,101	23.7	108	Reg.	Jan. '53

(*) Hardtop (†) Standard on this model (s) Shipping weight (a) With automatic transmission (p) With power steering



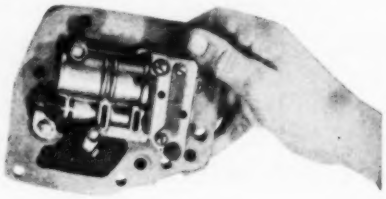
Standing still, the Chevvy's front wheels can be turned with thumb and forefinger. The steer-

Chevrolet Gets



HERE ARE THE FOUR elements of Chevvy's power steering, one of four big news items for '53.

THESE HAVE BEEN ADDED to the Powerglide transmission to give the car its new sass—a governor, at the left, and a throttle-valve body. They control the up-shifting and down-shifting.



ing-wheel "rim pull" is only seven pounds.

High-compression engine burns ordinary gas. New transmission gives a jack-rabbit take-off.

By Wilbur Shaw

PSM PHOTOS BY W. W. MORRIS

WHILE most of us were clacking our molars about the heat last summer, an ordinary-looking car with an ordinary-looking driver was making a secret run up Pikes Peak.

They started up in Colorado's pleasant summer temperatures. In the cold, thin air at the top, the driver was glad to don a coat. But his engine, packing a high compression ratio for a light car, buzzed right along on nonpremium gasoline.

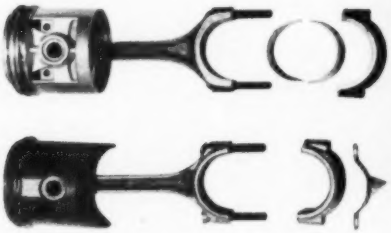
The driver was a testing engineer for Chevrolet, and his mount was a '53 car camouflaged with a '52 body.

He had an improved engine—and a lot more, for the new Chevvy has:

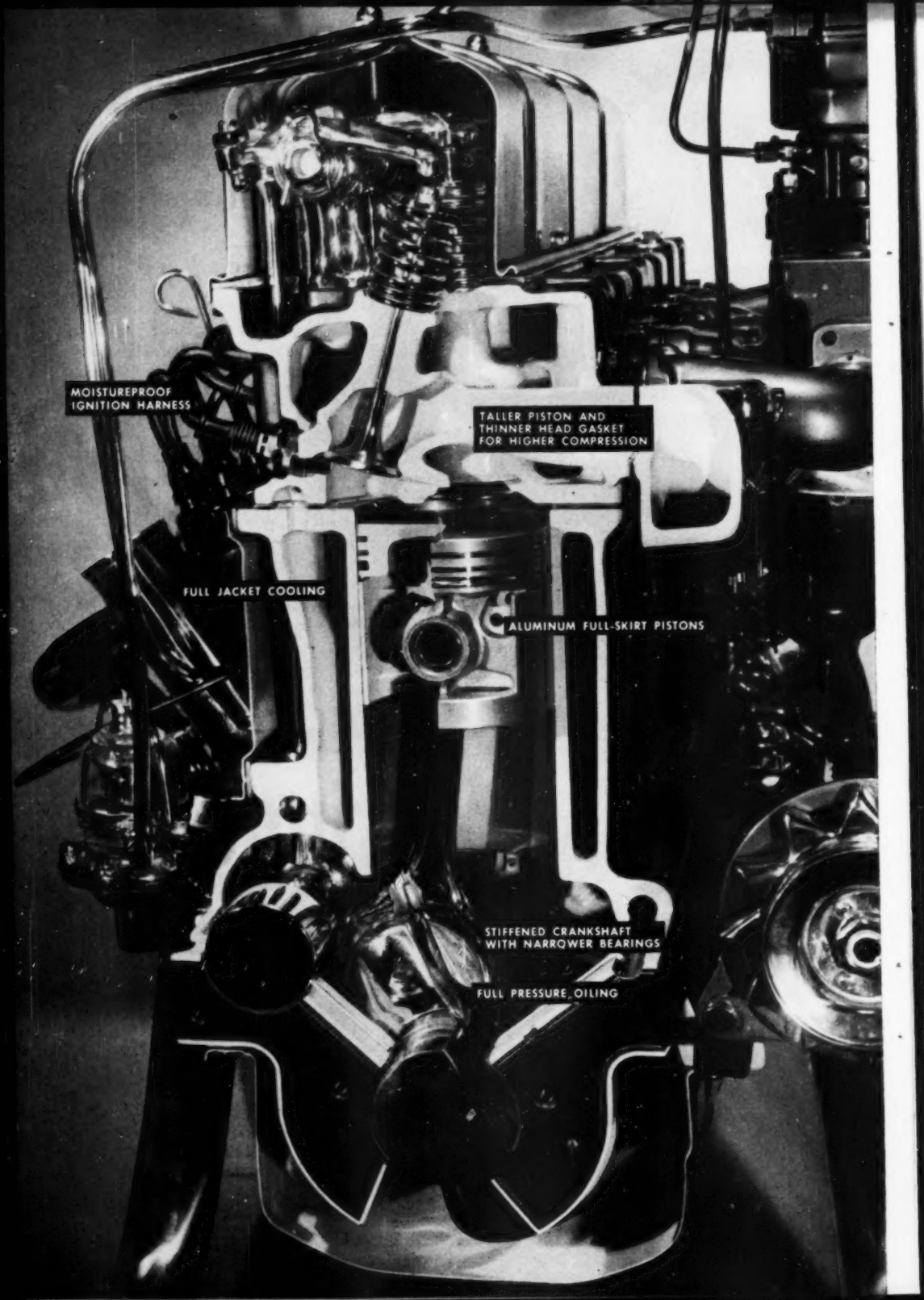
- Power steering, as an extra.
- A vastly improved transmission.
- Better brakes.
- Switch-key starting.
- And a complete job of restyling, with

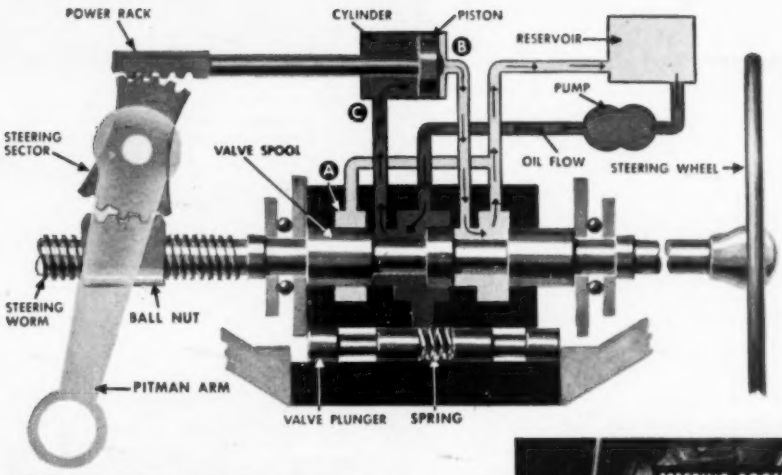
Power Steering

NEW ALUMINUM PISTON, with new insert rod bearings, is shown at the top. Old cast-iron job is at the bottom. Note the little triangular bucket to splash oil.



CHEVROLET'S NEW LINE of cars—the Bel Air—carries this strip on the rear fender.


MOISTUREPROOF
IGNITION HARNESS
TALLER PISTON AND
THINNER HEAD GASKET
FOR HIGHER COMPRESSION
FULL JACKET COOLING
ALUMINUM FULL-SKIRT PISTONS
STIFFENED CRANKSHAFT
WITH NARROWER BEARINGS
FULL PRESSURE OILING



HEART OF POWER STEERING is a valve spool grooved to open and close ports in a pressure hydraulic system. In the diagram above, heavy colored areas indicate oil under pressure from the pump. Light areas show static oil and oil being returned to the reservoir. The steering wheel has been turned to the left. The steering worm, threaded through a ball nut, has moved the valve spool to the right. This has closed port A, forbidding a return flow of oil to the reservoir through that passage, and port B, shutting off the flow of high-pressure oil to the right side of the cylinder. Pressure from the pump is concentrated on port C to fill the left side of the cylinder and move the piston to the right. Oil is draining from the right side back to the reservoir. The piston rod has pulled on the steering sector to move the Pitman arm for a left turn. For a right turn, the spool moves in the opposite direction.

The spool's full travel left and right covers only .06 inch. The spring, one of five surrounding the spool, preloads the valve plunger, forcing a pull of at least three pounds on the steering-wheel rim before the hydraulic system goes into action. This gives a steering feel to the driver. The springs also help center the spool when the steering wheel is released.

The photo at the right shows the installation of the unit in a car.

a brand-new line of cars: last year's Bel Air model is now the Bel Air series.

Power steering is the biggest surprise package in the new Chevrolet. Power steering for the lighter family of American automobiles was perhaps inevitable. If Big Sister uses lipstick, then the bobby soxer can, too.

Like almost all of the other power-steering units that have appeared in the last two years, Chevvy's is hydraulic. The engine drives a pump. The pump creates pressure. The pressure, fed to a double-acting piston, helps turn the wheels.

CHANGES shown at left add up to practically a new engine. The old compression ratio was only 6.7 to 1, the new one 7.5 to 1. The horsepower output is up from 105 to 115.

Steering Is Faster

I was glad to find out that Chevrolet, smartly enough, had made the steering a little "faster." It doesn't take quite as much movement of the steering wheel to negotiate a turn. And that, as I've been preaching ever since power steering made its appearance, is the single biggest contribution to safe driving that easier steering can make.

I ought to know. Topping a hill into the teeth of an oncoming car a year ago, I used power steering to save my life and those of my wife and son. With slow

steering, I never could have swerved out of the way.

In everyday use, the lady of the house will like power steering most when parking. It gives her a steering wheel that turns at least five times easier while she's trying to maneuver into that dinky space at the curb. Making the wheel a full inch bigger—18 inches in diameter—helps, too.

First Change in 16 Years

But to many of us, the big news in the '53 Chevvy is that engine, which has undergone major surgery for the first time in 16 years.

Critics have said that the old Chevrolet engine was as up-to-date as red-flannel underwear. While everybody else in Detroit was adopting full-pressure oiling, it plodded right along with a splash lubrication system. It had cast-iron pistons. It had connecting-rod bearings sprayed with a permanent hot babbit. It had a cooling system that failed to circulate the water in the jackets during the warm-up period.

It may have been out-of-date, but a salesman friend of mine told me recently, that in 50,000 miles of driving, his Chevrolet had cost him a total of 35 cents for repair—that went for a windshield wiper blade. Which may explain why Chevvy was slow to change.

Compression Is Higher

The new engine—available only in Chevrolets with automatic transmissions—has a full-pressure lubrication system. It has replaceable inserts for the bearings. It has aluminum pistons. It has a stiffer crankshaft. It has a cooling system that bypasses the radiator during the warm-up but circulates water around the cylinders.

And, most important, it burns ordinary gas on a compression ratio of 7.5 to 1—up nearly a full point from last year.

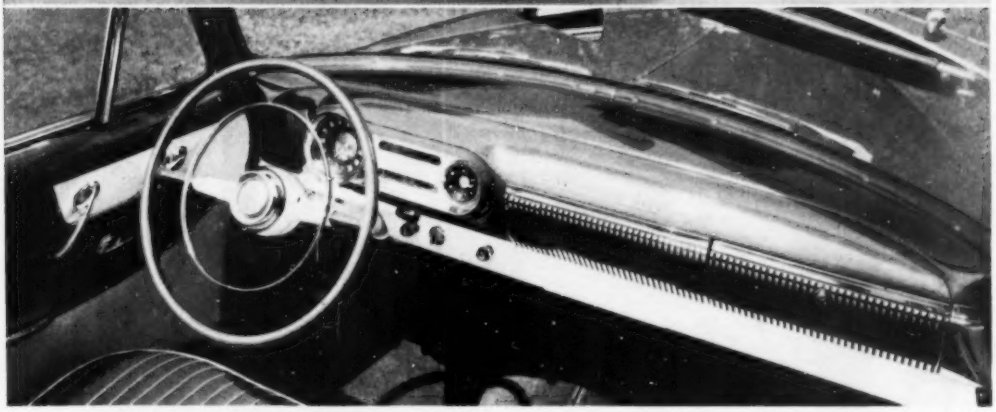
Results: Power is higher. Fuel mileage is improved. The engine is steadier, quieter, smoother.

I felt that—and more—in my accelerator foot when I boarded a new Chevrolet, equipped with the new automatic transmission, at the General Motors Proving Ground.

CHEVVY'S THREE LINES of cars for '53 include station wagon, convertible and sports coupe.

The car jumped when I stepped on the gas. I tried it again. From zero to 60 miles an hour took 19.6 seconds in Drive range. From 60 to 75 took 12½ seconds.

This was something new in Chevrolet performance. I checked that by driving a '52 Chevrolet against a stop watch. Zero to 60 in the older car took 25.9 seconds; 60 to 75, more than 15 seconds.



WRAP-AROUND REAR WINDOWS, high decks and combination tail lights are the chief changes in the rear. The panel includes switch-key starter. The windshields are one-piece.

The comparison on a 11.6-percent grade was even more startling. Starting at 10 miles an hour, the '52 car took almost 40 seconds to climb a distance of 1,400 feet. The new car did it in a bit over 31 seconds.

Gear Added to Converter

So the sluggishness in Chevrolet's Powerglide transmission has been cured. Ever since its introduction three years ago, Powerglide had required a start in Low range and a shift to Drive range for a fast getaway. The company knew this, of course. But it hesitated to make a change because it liked the extreme simplicity of that original transmission.

Now, for '53, the torque-converter transmission has been given an overhaul. To the gearbox behind it—common to all torque-converter transmissions to take care of emergency-low and reverse gears—have been added two items: a throttle

[*Continued on page 272*]

He's Talking Down an Airplane

THE airman above is guiding in a plane that has a curtain drawn over its cockpit to simulate bad weather. As the plane approaches the runway, the operator at the Ground Control Approach trainer instructs the pilot to center the plane in the sight. The pilot then makes a visual landing. Costing about $60 to build, the trainer prepares airmen to use costly GCA radar equipment that is installed at only a few fields. Lt. M. A. Fisher devised the system, shown in use at Perrin Air Force Base, Tex.

She's Trying Out a Thermotron

THIS blood donor is having her temperature taken electronically. The nurse will get a reading in 4½ seconds—about 60 times faster than she could with an ordinary thermometer. Called the thermotron, the machine is an industrial temperature indicator adapted by Minneapolis-Honeywell engineers for measuring body temperatures.

He's Building Bunker Furnaces

BECAUSE a hot war in Korea can also be plenty cold, Chief Warrant Officer Angelo Fabrize built himself a bunker heater from discarded mortar casings. It worked so well that M/Sgt. William W. Foot (above), shop foreman of the 702nd Ordnance Co. set GIs to turning out more of them. They'll burn wood, coal, oil or gas.

World's first hydro-ski jet fighter breaks water in taxi test.

A patch of water becomes a runway —ready-made and bombproof— for this new kind of seaplane.

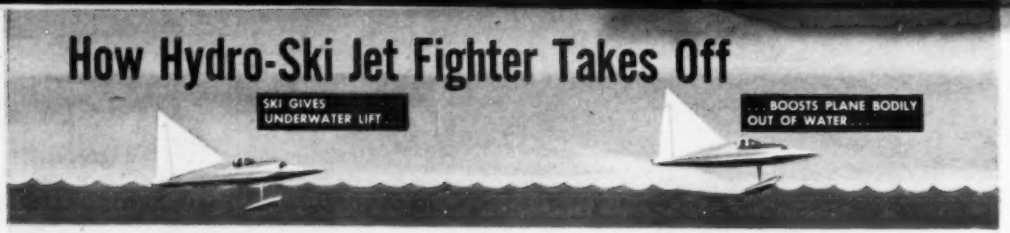
Jets on Skis Can Use Oceans for Airfields

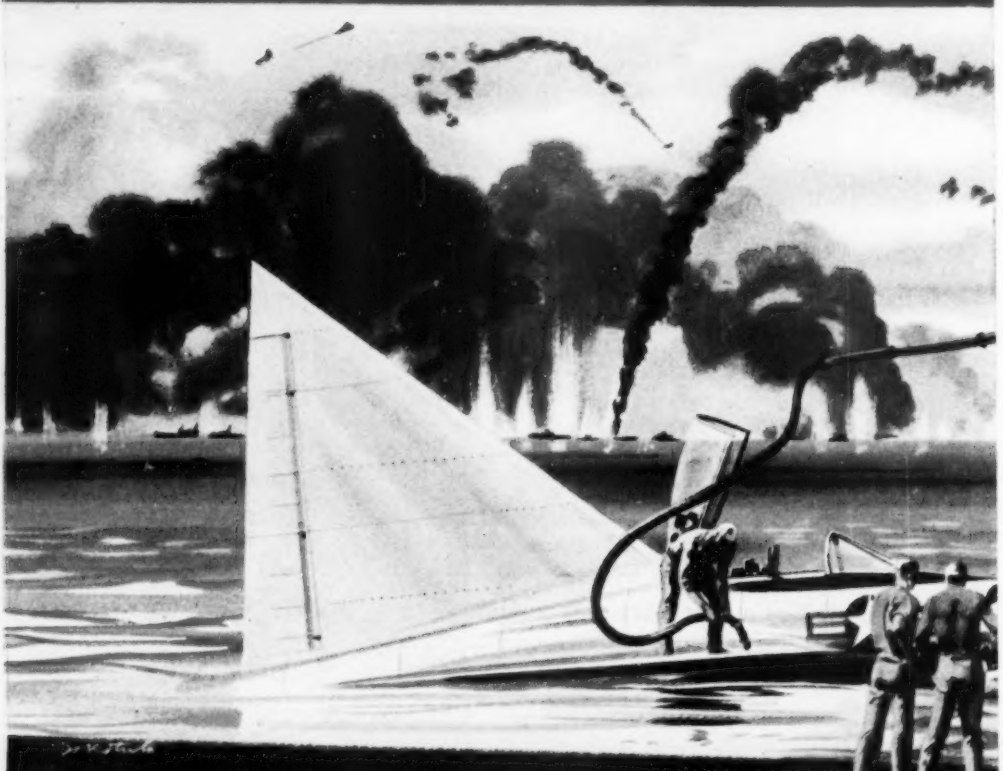
By Herbert O. Johansen

COULD a submarine refuel a supersonic jet fighter in mid-ocean? It sounds silly. How would you get the submarine up in the sky? Or the fighter down to the submarine?

A way to use the sea's vast surface as a field for a faster-than-sound fighter plane has been found now by the U. S. Navy. The plane is the Convair XF2Y. And the device that is expected to make the jet a seaplane—and possibly revolutionize aviation—is a thousand or more years old. It is a ski such as ancient Lapps used to skim over snow, and

How Hydro-Ski Jet Fighter Takes Off



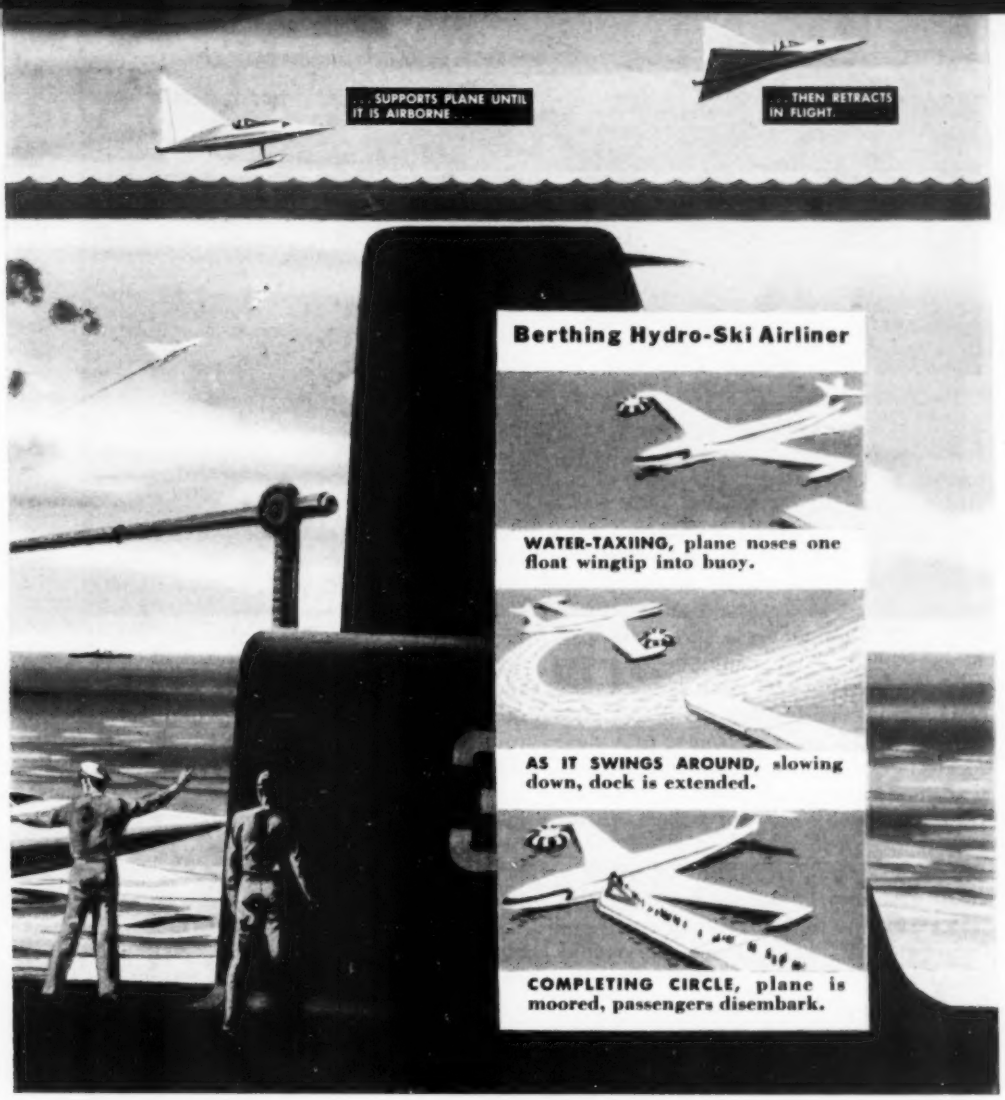


OCEANS MAY BECOME RUNWAYS for supersonic hydro-ski jet fighters. Artist's conception above shows how such a plane might refuel from a submarine.

bathing beauties use right now to skim the waves behind speedboats in Florida.

The Convair XF2Y Sea Dart, shown on the preceding page trying out its hydro-ski gear during preflight tests in San Diego Bay, is a delta-wing, twin-jet job. It has no horizontal tail but a triangular-shaped vertical fin. When the plane is at rest on the water, the hydro-ski, projecting beneath the fuselage, is submerged. As the plane starts, the ski acts as a hydrofoil, giving underwater lift. Suddenly, it boosts the craft bodily out of the water, nose up. Then, as the hydro-ski itself breaks through the surface with a short burst of fine spray, it becomes a planing surface, supporting the airplane on the water as it accelerates to take off.

When the plane is airborne, the hydro-ski will be retracted, like the wheels beneath a landplane, to eliminate air drag in flight. For a landing, the hydro-ski will be lowered in flight. As it touches

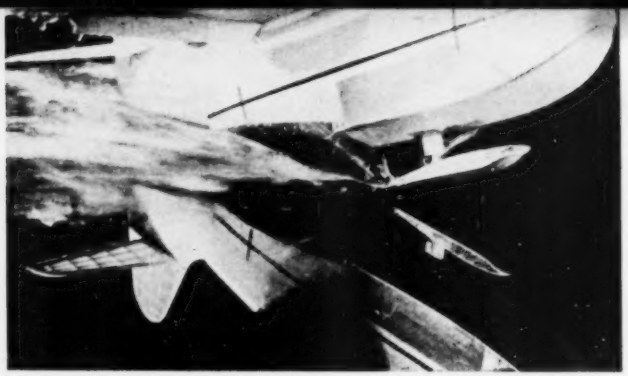


the water and the plane slows down, the ski will take on more and more of the load. And when the weight becomes too great, the ski will submerge, allowing the airplane to float on the water.

Glenn Curtiss built a flying boat 40 years ago. More recently, improved models carried transoceanic passengers. But land-based planes displaced the flying boats because they were faster. Now, jet engines make possible water-based planes without the bulky hulls which dragged the old flying boats out of the picture.

With jets, a high wing is no longer needed because there are no propellers to keep out of the water. A low wing can settle right down on the water and act as a float. The underside of the fuselage must be watertight, of course, but this is not a difficult requirement—and retractable wingtip floats can be added if needed.

Jets *and* hydro-skis have thus made a



TANK TESTS on models showed that hydro-skis give remarkable underwater lift. In photo at left, note small, fine spray as the ski breaks through water. Another result of these early NACA tests was proof that smooth landings at high speeds could be made in rough water. Fact that skis could be small enough to retract was an important factor in Navy's decision to build full-scale plane.

true, high-speed, water-based airplane feasible. The Navy will not abandon carriers or stop seizing islands in offensive campaigns. "Not yet anyway," officers insist. But the value of the hydro-ski fighter was indicated by John H. Floberg, Assistant Secretary of the Navy for Air, when he disclosed the existence of the XF2Y a few weeks ago. "Perhaps," Floberg said, "they could be based in forward areas where protected waters exist before land bases could be constructed . . . Thus, they might provide a means of ending to some extent the costly wartime program of building airstrips which are useful only for a short critical period."

Hydro-ski fighters, refueling from a small, fast ship or submarine, could use water airstrips that the enemy could not damage with bombs. The water would be as smooth a few minutes after the bombs fell as it was before.

Since these planes need no catapult for launching or deck runway for landing, submarines might become underwater aircraft carriers. Why not even a big, nuclear-powered submarine and atom-bomb-carrying ski planes? That combination could get right into the back yard of any enemy with a knockout punch.

Bush Pilots Tried It First

The Edo Corp. was the first to put hydro-skis on a full-size plane in an experimental project for the Air Force. Borrowing from the makeshift techniques of bush pilots who use skis to land on the lakes and snow in Canada and Alaska, Edo designed a small, twin-hydro-ski that will make any light landplane equally at home on water, ice, snow, bogs—or even grass.

Can hydro-skis also make water babies of the big commercial airliners? They certainly can when airliners have jet engines. And they would eliminate much airport congestion. Near most big cities are vast water runways whose length is measured in miles instead of thousands of feet. They cost nothing to build, nothing to maintain. And even if commercial jet seaplanes had to land some distance from a city, they could water-taxi to lake-, harbor- or river-front berths near the heart of the metropolis.

Jets Have to Be Strong

But how could such planes take the impact of water landings without strengthening that would add too much weight and bulk? Jets answered that. Their fuselages have to be strong enough to take water landings in order to withstand 600-mile-an-hour airspeeds. New light, strong metals have done the job.

But hydro-skis big enough to support a huge transatlantic airliner might cause prohibitive drag when under water, which is 800 times denser than air.

Hydro-ski enthusiasts say that this problem, too, can be solved. Another approach might be the "blended hull" developed by Ernest G. Stout, Consolidated Vultee engineer. It is highly efficient both on water and in the air. But the Navy has abandoned this "Skate" hull in favor of the hydro-ski for its first high-speed jet seaplane fighter. END

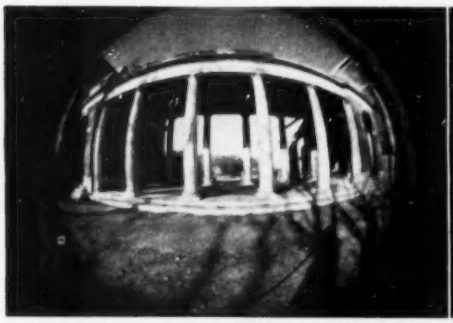
Here's How the World Looks to a Fish

THE man whose distorted face stares at you from above the headline has only himself to blame for the way he looks. He's William M. Sinton, a Johns Hopkins physicist, and the picture is a self-portrait. It was taken with a special lens he devised for his camera to enable him to show us how he thinks we look to fish, whose view of our world is never a true one because they are staring at it through water.

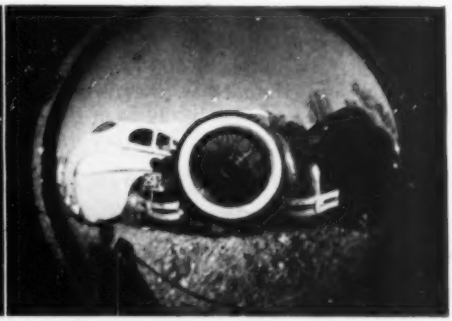
If you have mastered the uncomfortable trick of opening your eyes under water you already have a good idea of what a fish is up against. Nothing looks straight.

The lens that Sinton made consists of a flat piece of glass behind which is cemented a hemispherical lens that gathers light over a 180-degree angle. He screwed the lens into his Leica and took the photos on this page.

Sinton improved upon an idea of a former teacher of his, Prof. Robert A. Wood, who about 36 years ago made a camera out of a bucket of water. Professor Wood placed his plate at the bottom of the bucket, mounted a lens halfway between the bottom and the surface, and took pictures of a railroad trestle from underneath.

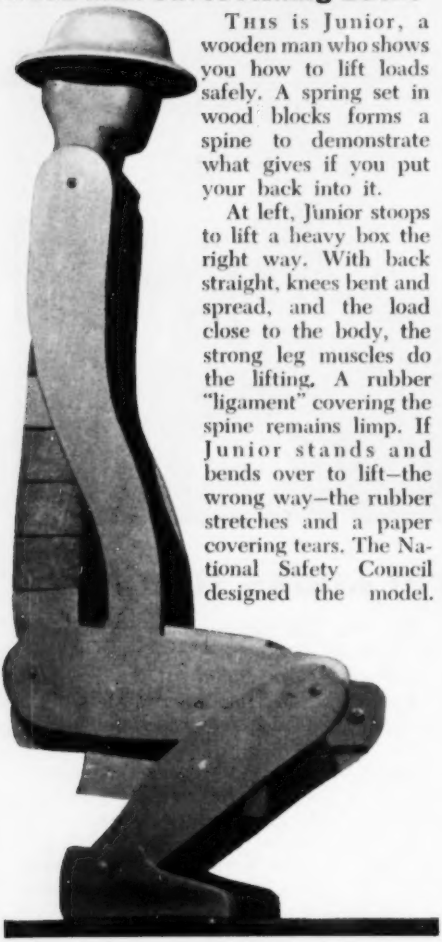


THESE COLUMNS ARE STRAIGHT and the colonnade is rectangular. Sinton's fish-eye lens makes the colonnade seem circular, while the columns look as if Samson had been at them.



A THREE-WAY CRASH, you might think, to look at Sinton's distorted camera view of three automobiles that simply happened to be parked close together. But they weren't touching.

Wood Man Saves Aching Backs



THIS is Junior, a wooden man who shows you how to lift loads safely. A spring set in wood blocks forms a spine to demonstrate what gives if you put your back into it.

At left, Junior stoops to lift a heavy box the right way. With back straight, knees bent and spread, and the load close to the body, the strong leg muscles do the lifting. A rubber "ligament" covering the spine remains limp. If Junior stands and bends over to lift—the wrong way—the rubber stretches and a paper covering tears. The National Safety Council designed the model.

Out Through the Roof

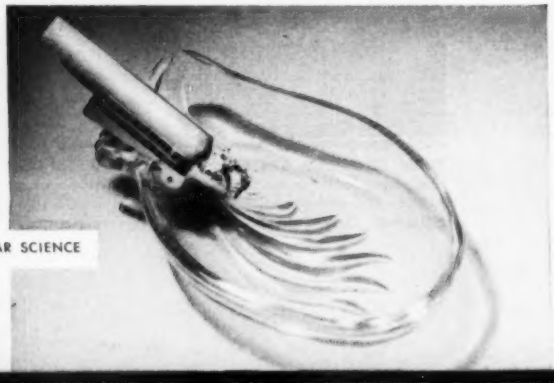
THAT's just a dummy you see above in mid-air strapped to an airplane ejection seat. He has just been fired out of an experimental cockpit. Because a jammed canopy can mean death to a pilot when he wants a fast out, the Navy is experimenting with the possibility of blasting seat and pilot right through the plastic. Pieces of the shattered canopy (painted white) can be seen in the air. The spread net catches the dummy and seat so that tests can be repeated.

Cutting Hone Sharpens Scissors

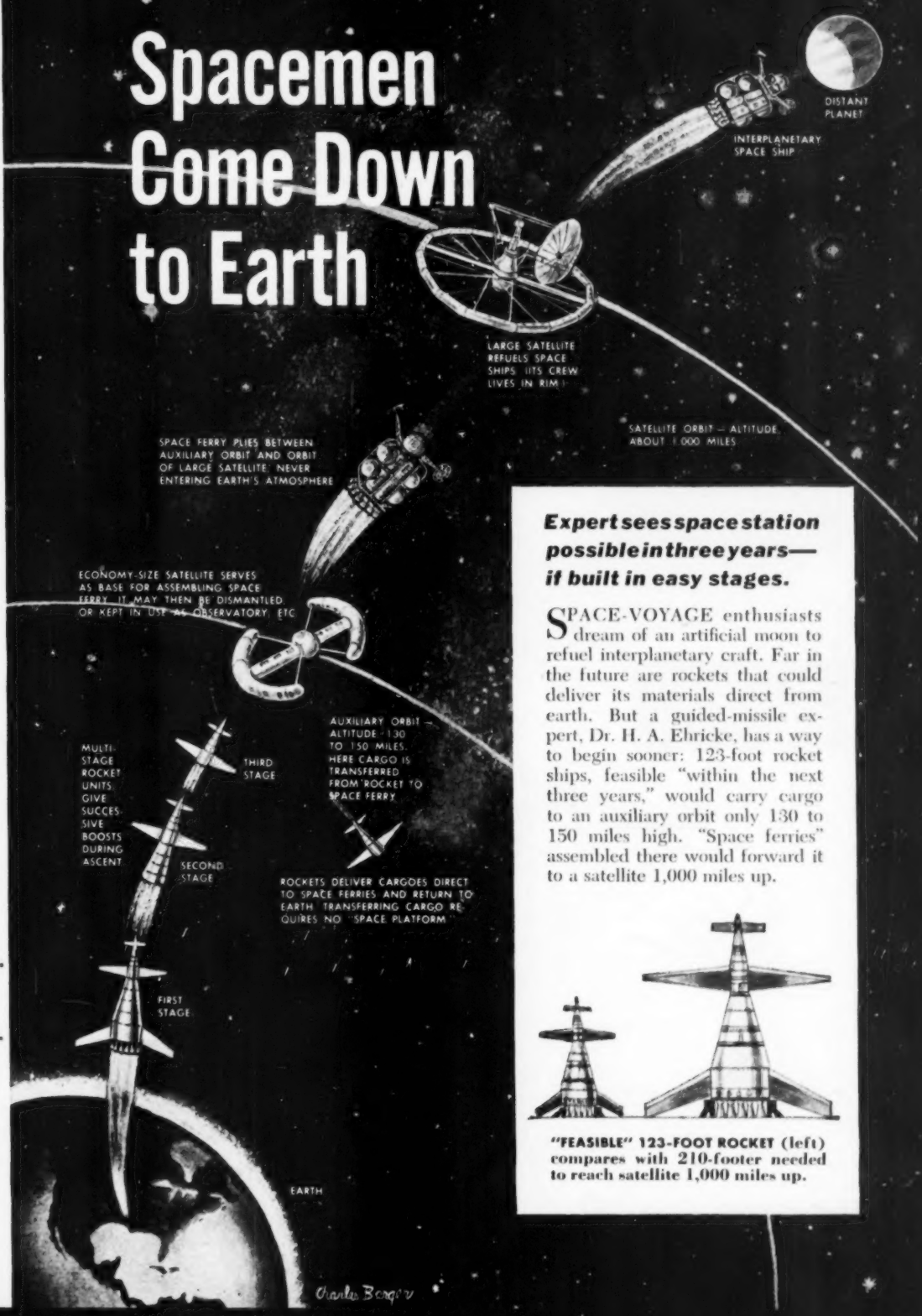
JUST cutting across the hone on this sharpener with a pair of scissors gives them a new edge. As the blades are pushed forward and pressed together, the carborundum hone adjusts automatically to fit them. Dritz, 1115 Broadway, NYC, makes it.

Ash Tray Dumps Burning Butts

A HEAT-SENSITIVE hinge on a new ash tray flips up the metal rest at an angle so that a burning cigarette will never fall to the table but will rest safely until it slides into the tray or burns out. Bill Watt, 245 Huguenot St., New Rochelle, N.Y., sells it.



Spacemen Come Down to Earth



Expert sees space station possible in three years— if built in easy stages.

SPACE-VOYAGE enthusiasts dream of an artificial moon to refuel interplanetary craft. Far in the future are rockets that could deliver its materials direct from earth. But a guided-missile expert, Dr. H. A. Ehricke, has a way to begin sooner: 123-foot rocket ships, feasible "within the next three years," would carry cargo to an auxiliary orbit only 130 to 150 miles high. "Space ferries" assembled there would forward it to a satellite 1,000 miles up.

"FEASIBLE" 123-FOOT ROCKET (left) compares with 210-footer needed to reach satellite 1,000 miles up.

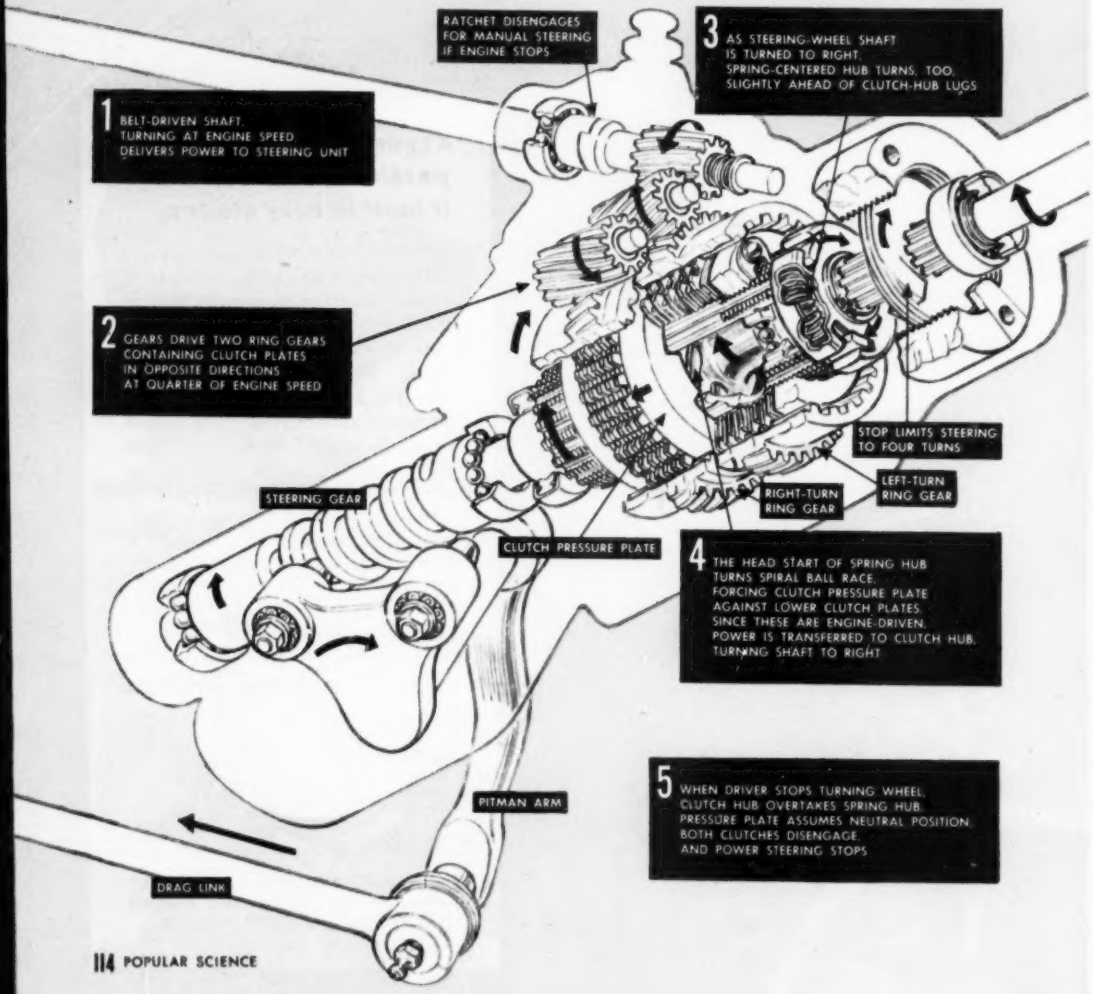
Engine Helps Steer '53

New model with foreign look has first mechanical power steering and cheaper than the hydraulic type—also better, say

By Wesley S. Griswold

FULLY mechanical power steering—first in the field—and new body styling with a foreign look are the chief talking points about Studebaker's 1953 lines.

The power-steering apparatus, though marvelously ingenious and precisely machined, is essentially simple, as the drawings on these pages show. The power unit, which is the heart of it, is only six inches long and six inches wide and weighs but 22 pounds. It is bolted onto the steering shaft just aft of the gearbox,



Studebakers

on the market. It is simpler company's engineers.

HOW POWER-STEERING UNIT WORKS ON A RIGHT TURN

1953 CHAMPION hard top has center of gravity only 22 inches above road. Frontal area is 22.25 sq. ft., smallest ever.

to which it is connected, and takes its power from the engine by means of a belt.

The power unit consists of a gear train and two small clutches, one for each direction that you want to turn. The ring gears that drive the clutch plates revolve constantly while the engine is running, one to the left and the other to the right, but at one-quarter engine speed.

Engine Does 75 Percent of Work

When you turn the steering wheel to the left, the top ring gear drives the upper set of clutch plates and takes 75 percent of the steering effort off your hands. When you turn the steering wheel to the right, the bottom ring gear drives the lower set of clutch plates and gives you an equally effective assist. The instant that you quit turning the wheel, the clutches disengage and the ring gears run free. If the belt to the power unit should break, the car automatically reverts to normal steering.

Studebaker's engineers contend that mechanical power steering is both better and cheaper than the popular hydraulic varieties. There's no chance for leakage, they say, no high-pressure pump to worry about, far fewer parts to get out of adjustment and significantly less fuel consumption and power loss. I can vouch that it drives as well as the best of the three leading hydraulic makes, for I have tried them all.

At the time I sampled Studebaker's power steering, no one could tell me how much cheaper than hydraulic power steering it was going to be. Costs to the consumer had not yet been figured out. Everybody agreed, however, that it should cost less right from the start. And if H. E. Churchill, Studebak-

FACTS ON '53 STUDEBAKER

Model: Champion hard-top convertible.

Engine: 6-cyl. L-head; 85 hp. at 4,000 r.p.m.; compression ratio, 7.5:1; piston displacement, 169.6 cu. in.; bore and stroke, 3" by 4"; piston travel (in feet per car mile at 20 m.p.h.), 2,107; crankshaft bearing surface, 12.41 sq. in.; torque, 138 lb.-ft. at 2,400 r.p.m.

Weight: 2,750 lb.; per hp., 32.35 lb.

Transmission: torque converter with gears; rear-axle ratio, 4.10:1.

Steering ratio: 19.4:1 (with power steering); radius of turning circle, 20'.

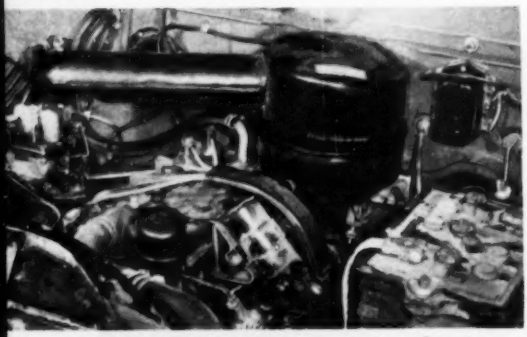
Effective brake-lining area: 144 sq. in.

Springs: front, coil; rear, semi-elliptic.

Outside dimensions: height, 56 5/16" (loaded); over-all length with bumpers and guards, 201 15/16"; width, 71"; wheelbase, 120½"; overhang, front 33 15/16", rear 47½"; tread, front 56 7/16", rear 55½".

Inside dimensions: seat-cushion width, front 60", rear 58"; leg room, front 44¾", rear 35"; headroom, front 36 5/16", rear 35¾"; seat height, front 10⅝", rear 11¾"; vertical distance, steering wheel to seat cushion, with seat in mid-position, 5¾"; front-seat adjustment, horizontal 5½", vertical 15/16".

Tire size: 6.40 by 15.

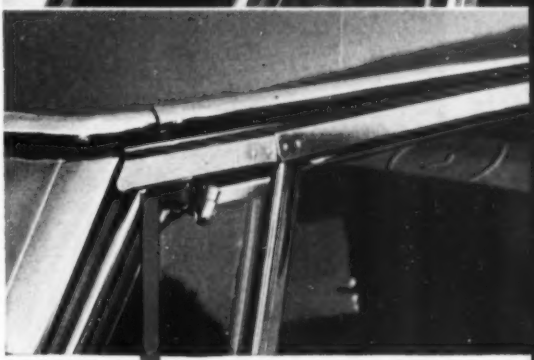


NEW DRY AIR CLEANER (top center above) contains a treated-paper filter, said to remove as much dust and foreign matter as conventional oil bath—and at a lower price.

er's vice-president in charge of engineering, proves to be right in predicting that mechanical power steering will gradually replace the hydraulic types and be universally adopted, eventually it should cost very much less.

Studebaker engineering tests have proved that when a car equipped with mechanical power steering is being driven straight down a road at 40 miles an hour, only a little more than one-seventh of one horsepower is required to keep the ring gears in the power unit moving. On the other hand, the engineers found out that at 40 miles an hour, driving straight ahead, it takes a fraction over one

CLEAN, SWEEPING LINES are evident in the rear as well as the front of the 1953 Champion hard-top convertible. The little lights above the hind bumper are back-up lights—extra.



KEEPING RAIN OUT OF WINDOWS is achieved by spring-loaded metal flap (right) that, turns down over window edge when door is closed against tiny lever (arrow).

horsepower to maintain the oil pressure for a typical hydraulic power-steering system.

You can appreciate what this difference means in terms of fuel consumption when you learn that it takes 12 horsepower to keep a Studebaker Commander (eight cylinders) moving at 40 miles an hour, using overdrive. If that car were equipped with hydraulic power steering, eight percent more horsepower (and fuel) would be needed simply to maintain pressure for a steering system that, so long as the driver kept going straight, wasn't doing any work. On the other hand, if the same car were equipped with mechanical power steering, only 1¼ percent more horsepower would be consumed.

Incidentally, this new power steering of Studebaker's is an all-Hoosier pro-

[*Continued on page 244*]

MAN OF AVERAGE HEIGHT stands head and shoulders above Champion hard top. The '53 coupe has same dimensions.

REAR-VIEW MIRROR of the 1952 cars (below) was in an awkward spot. In new models (right below) it is better located. The 1953 cars also have up to 33 percent more window area.

MORE OF THE ROAD is visible from the wheel of the 1953 Champion hard top (below) than from that of the '52 model (left below), even though the '53 hood is eight inches longer.

Bank in Bus Comes to Meet Customers

Two banks on wheels are making regular trips into rural districts of Puerto Rico to meet depositors, arrange loans and give investment advice. The banks are set up in Diesel buses, with a full staff of tellers and other trained personnel. Their country customers have no other banking facilities.

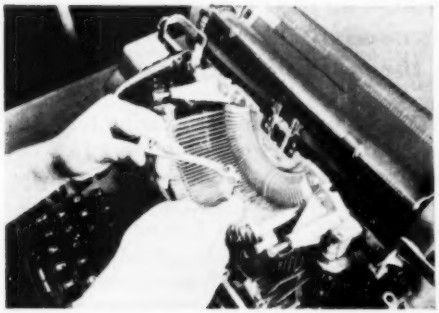
The Banco Popular, which runs the bus banks, hopes in time to have 20 of them, serving 52 communities. Buses in use now have internal phone systems that can be hooked up to the trunk lines wherever they park, usually under a spreading canopy.

Walt Disney Builds Half-Pint History

THE delighted face at the door (left) is not Alice's, nor is the scene Wonderland. Instead, a grown girl is peering into a 30-inch-long living room in Disneyland, a miniature historic America that is to cover a 50-acre tract in Los Angeles.

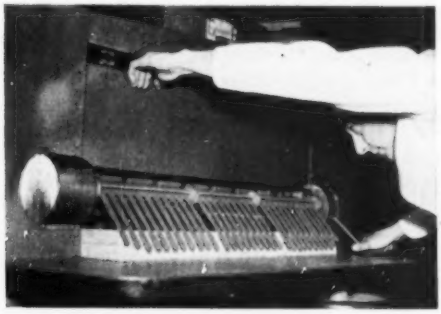
Disneyland, which still has a long way to grow, is the latest enthusiasm of the celebrated creator (above) of Mickey Mouse. Its purpose is to entertain people of all ages and also to teach them by means of tiny but exact models how life in the U.S. developed to its present level.

Disney has collected miniature copies of antique furnishings from all over the country and built others in his studio workshops. He has set farmhouses among "crops" of paper, cloth, wax and wood.



Want New Type? Hook It On

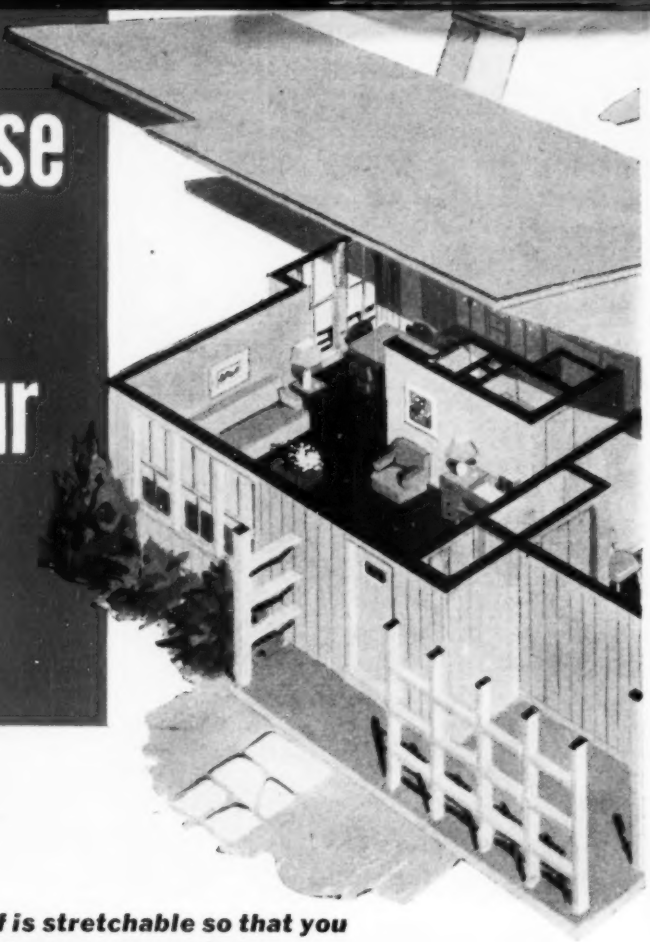
EASILY changeable type bars with chemical, mathematical and other scientific symbols, as well as foreign-language characters, have been developed for electric typewriters by IBM and the Atomic Energy Commission. They were requested for special work at Oak Ridge. A typist can hook them on or take them off in seconds.



Paper Cutter Can't Cut Hands

THE operator of the power paper cutter above would really have to work hard to get his hands trimmed at the same time. A grille screens the cutting blade, and the machine won't run until the operator's hands are both working levers well out of harm's way. The cutter was developed for the British printing industry.

This House Grows with Your Family



Its roof is stretchable so that you can add rooms as needed without spoiling the looks of the place.

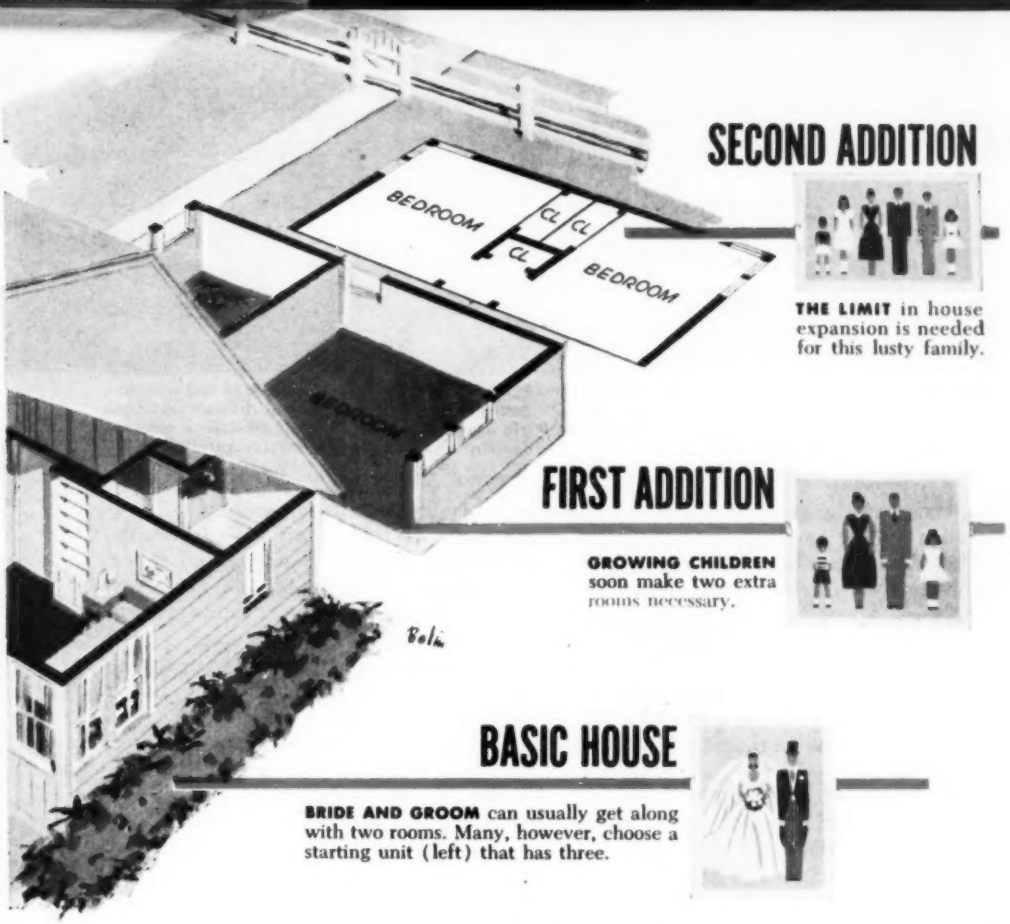
By Thomas R. Henry

ARCHITECTS working for the Department of Agriculture are designing baby farmhouses for babyless farmers. These will grow up into full-sized farmhouses for full-sized families.

The idea is for the young farmer and his bride to start with two, or at most three, well built rooms—which can be expanded to six or seven, two rooms at a time, as the family increases. Already building plans for four types have been distributed and three more are being tested at the Agricultural Research Center, Beltsville, Md.

The baby farmhouses usually start out as cellarless structures containing a kitchen-dinette and a living room-bedroom. This is about what a bride and groom would begin with in the average one-room city apartment. It's plenty for two young people who both have jobs and no great accumulation of furnishings. A city couple just moves out when the honeymoon nest gets too small. It can't be stretched. The farm couple, on the other hand, must stay where they are, adding to the house they have or building a new one.

Many a still-extant farmhouse is built around the nucleus of the old log cabin



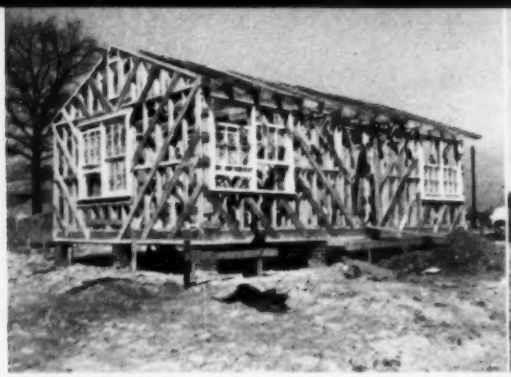
that Great-grandfather put up in the clearing when he came as a homesteader. This has led to a peculiarly American style of architecture—without benefit, until lately, of architects—the "rambling" house now so popular in the suburbs.

But on the farm the result often has been an atrocity with bedrooms so scattered that occupants must go through a couple of other bedrooms to reach their own quarters, and with kitchen and living room altogether out of proportion to the rest of the house.

This won't happen to the new stretchable farmhouses. The plans envisage the entire house which may sometime be

IN A TWO-ROOM UNIT, a trellis separates dinette from living room without loss of light.

LIVING ROOM ALSO SERVES as bedroom—the sofa is really a camouflaged standard bed.



THERE'S NO CELLAR to start with. The completed framework of a two-room basic house here stands on brick piers. Plans allow for cellar to be dug later, entered from outside.

READY FOR PAINTING, the basic house now has concrete retaining walls and doorsteps. Simple design makes sure that additions will not destroy clean lines of "starter" house.

built around the nucleus of the original kitchen-dinette and living room-bedroom. Rooms can be added in pairs and fit perfectly with the original structure.

Rooms for Sprouting Teen Agers

The day will come when the teen-age girls will want a room of their own. A living room big enough for two will be badly crowded when there is a family of six or eight.

The houses are so designed that cellars can be dug under them someday. They have—perhaps the most significant feature of all—stretchable roofs. In the end, one continuous roof will cover the whole structure.

The cost of the honeymoon-nest nucleus, of course, will vary greatly for different parts of the country. The average, at present costs of material and labor, is estimated at about $6,000. The plans for the stretchable houses, however, are drawn up so that the average young farmer who is fairly handy with tools—and most farmers have to be—can do the greater part of the work himself.

Three kinds of material can be used for the walls—cement-asbestos board, cinder block, lumber. Each offers advantages for particular localities.

The basic idea is simple enough. But the work has involved an enormous amount of architectural detail to make sure that the baby houses will grow up into good-looking adult houses rather than

A HOME WORKSHOP could easily produce the plywood table and bookcase-cupboard shown at left. Designed for the small house above, they were planned with the idea that a man fairly handy with tools could build them.

An owner's wife is here stowing away pillows in a storage cabinet with bottom-hinged door. The bed slides partly under cabinet.

WHEN THE TIME COMES, the basic house expands with a neatness that is possible only because just such an addition was planned from the start. Stretchable houses were designed primarily for young farmers whose cash income not only is small but must mainly be devoted to developing their land rather than their farmhouses.

the oddities that are familiar sights in the land.

Throughout, the architects have recognized that the farmhouse is the province of the farmer's wife, and each step of the planning has been taken in cooperation with the Agriculture Department's homemaking experts. Each of the experimental models has been tried first with young couples with jobs at the nearby Bureau of Dairy Industry.

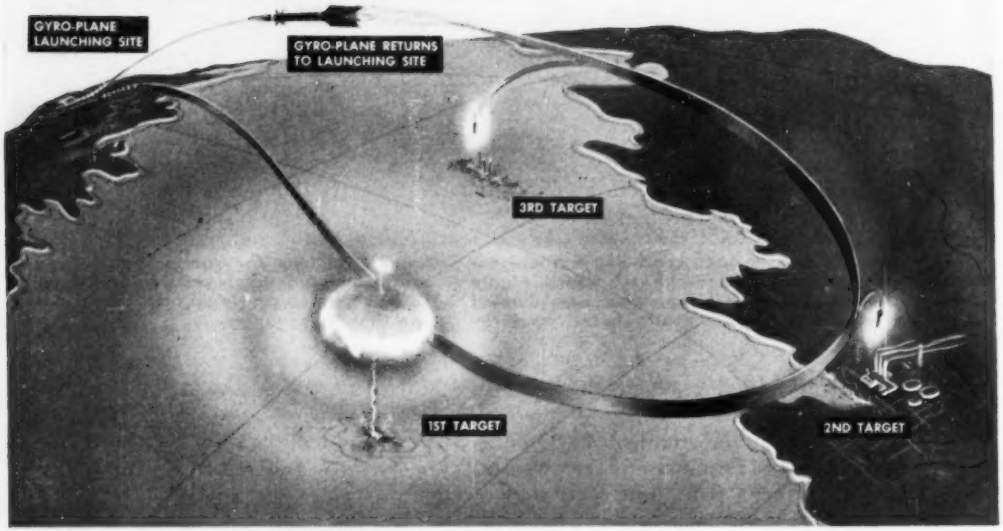
"As the houses are lived in," says Mrs. Lenore Sater Thye, head of the Department's housing and household equipment research, "we have an opportunity to observe how the families use the space, how their flooring, paint and table tops are holding up."

Room Divided by Screening

The two to three rooms of the models thus far designed cover a ground space of 20 by 30 feet. The living room is usually 12 by 19 feet—fairly large as living rooms go and big enough to entertain 10 to 12 people. It is so arranged that it can be divided into two rooms by curtains or screens, making one end a bedroom. In the three-room models, one of which is illustrated on the opening pages of this article, the owners start married life with a separate bedroom.

The furnishings are pretty well standardized, on the assumption that the young farmer and his wife have just started housekeeping. They can, of course, vary the assortment as they please, but the result will not be quite as symmetrical. Bed lounges 39 inches wide are placed at opposite ends of the living room. Behind each is a long wall cupboard with a storage compartment. Each of these cupboards has an upper bookshelf. END

OWNERS NEED LITTLE HELP in building one of the expansible houses shown on these pages. In some cases, only skilled labor hired was for plumbing and electrical installations.



Midget Gyro May Pilot Super-Accurate Air Weapon

A TINY gyroscope, weighing perhaps a pound, would eliminate the pilot and navigator of a long-range aircraft visualized by Arthur V. Sommer of the Arma Corp. Thus the craft could fly at greater speeds and altitudes than a human being could endure. Its gyro-guidance system, navigating by the stars, would enable it to strike at a series of targets with unerring accuracy. The system could not be jammed nor the craft diverted by an enemy. Such a system, Sommer said recently, "is within reach today."

Navy Will Use Steam Slingshot for Carrier Launchings

THE new U.S. supercarrier *Forrestal*, now under construction, will launch some of its fast jet fighters from a new catapult powered by steam from the ship's boilers. The British-developed device, shown catapulting a Vickers Supermarine Attacker from HMS *Perseus*, will enable planes to be launched even when the carrier is at anchor or headed downwind. A hook on the aircraft is connected to a piston which is driven along a slotted cylinder. A sealing device keeps the cylinder steamtight.

Wingless Plane Passes First Test—Gets Off the Ground

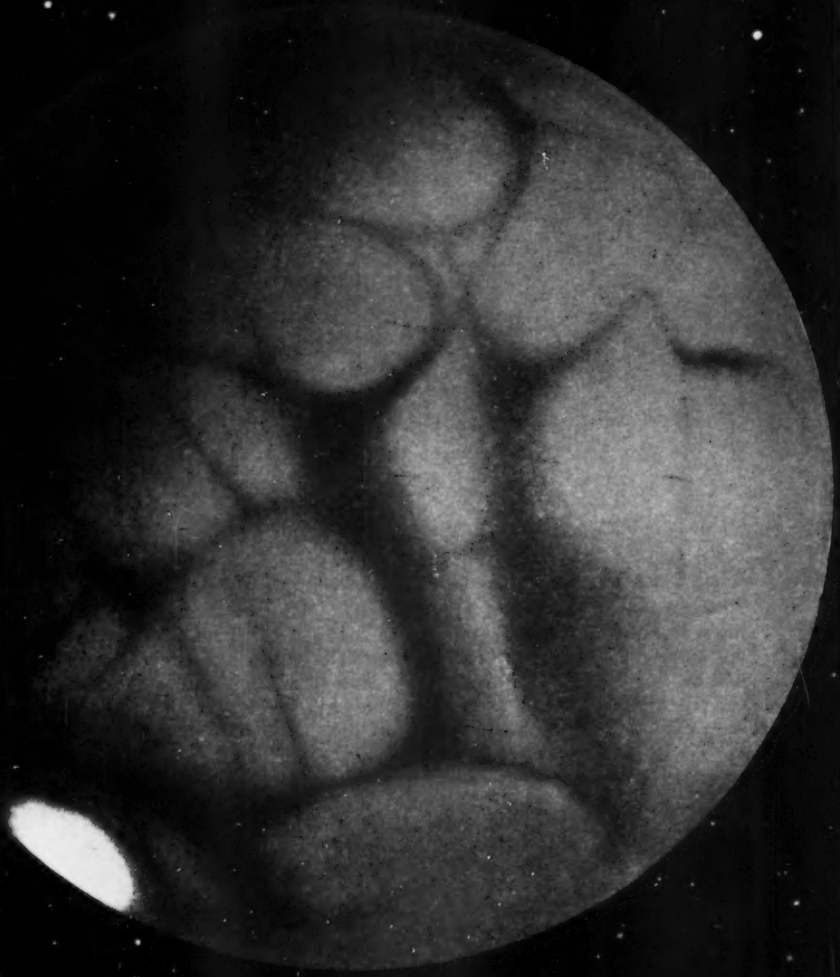
THAT'S not a wingtip at upper right above, but one of two retractable eight-foot flaps to give added lift to this experimental wingless plane. Bill Horton, aircraft engineer, designed the strange craft around a Cessna monoplane. Vertical "sealers" at the tips of the fuselage increase lift, he claims, by keeping air surrounding the craft in flight from mixing with air flowing over its lifting contour. During its first high-speed taxi test at Santa Ana, Calif., the plane rose 10 feet above the runway.

British Streamline Motorbike

BRITISH conservatism got lost in the design of this lightweight motorcycle. A streamlined cowling swoops over a shallow, S-shaped tubular frame, and a bulbous grille covers the two-stroke motor. The Commander is made by the General Steel Group.

Records Get the Brush Off

A PHONOGRAPH needle is really in the groove when this tiny brush sweeps dirt and dust before it. The brush is inset in tape which adheres to the tone arm when pressed into place. Permo, Inc., 6415 Ravenswood Ave., Chicago 26, makes it.



Composite drawing shows Mars and site of 200-inch telescope that may reveal its secrets.

a Leydenfrost

Does Anybody Live on Mars?

When the big red planet swings close to Earth in 1956, giant telescopes may settle the question once and for all.

This is the first of two articles on Mars. *Next month:* How men from Earth will land and live on Mars.

By Morton Clurman

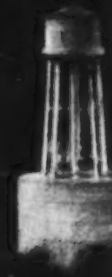
IS THERE life on Mars? We may know in 1956.

When the red planet swings closest to Earth, at intervals of 15 to 17 years, there comes the most favorable moment for astronomers to try to solve such riddles as the faint markings called "canals." The next opportunity will be three years hence.

Like all other planets and their satellites, Mars is too cool to give off light of its own and must be observed and photographed by the relatively feeble reflected light of the sun. In the past, getting an adequate photograph of Mars has required a long time exposure. And the longer the exposure, the more blurred was the image. But now there is new hope.

This time a mighty new eye will be among the telescopes trained upon Mars —the big 200-inch scope on Mount Palomar in California. Its 16-foot mirror gives it four times the light-gathering power of its nearest rival. This should permit taking motion pictures when Mars is again in a favorable position. And with the hundreds of thousands of short-exposure frames to choose from, there is a good chance that the Palomar films will yield a few sharp enough to answer the canal riddle once and for all.

For centuries men had gazed at the heavens and speculated about life on other planets. But in 1877 Giovanni Schiaparelli, in the Milan Observatory, Italy,



looking through a telescope at Mars saw something that transformed such speculations into a scientific problem. Schiaparelli had been peering at Mars for years. He had seen, as others had, the bright orange patches believed to be dry land, the bluish-green dark patches once regarded as seas and the glittering white polar caps which waxed and waned with the Martian seasons.

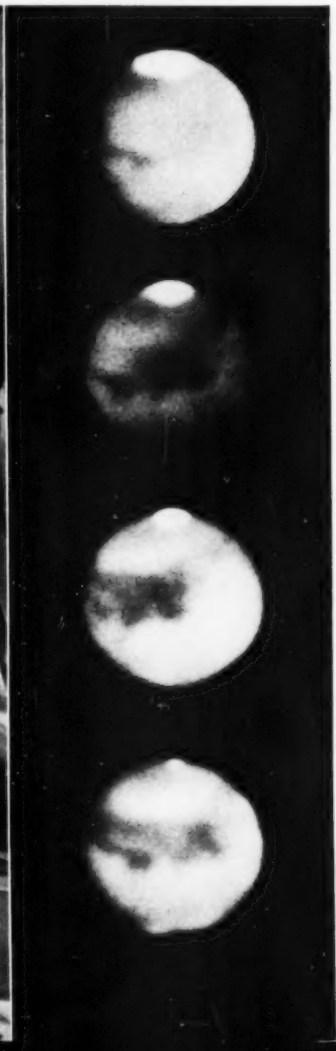
But now he was peering just a little more carefully than usual, for in that year Mars was as close as it ever gets to the earth—35 million miles away.

Under perfect atmospheric conditions, Schiaparelli discovered faint, dusky streaks linking the light Martian "land" areas with the darker "seas." These he named *canali*—literally, channels. A surprising feature about the "canali" was their doubling. This occurred particularly, said Schiaparelli, in the months following the melting of the polar cap. In the course of a few days a single dusky line would be transformed into two parallel lines following the original course.

Mistakenly translated as "canals," which implied waterways constructed by intelligent creatures, these *canali* caused millions to speculate on the probability

GIANT SCOPE AT PALOMAR will be mightiest ever trained on Mars. Looking down into it, you see its 200-inch mirror—and a reflection of the photographer who took this picture.

MARS PHOTOS by Lowell Observatory show polar cap (white disk) at intervals from winter to summer (top to bottom). Rapid shrinking suggests it may be less than inch thick.



The Odds Favor Life Elsewhere

SOMEWHERE in space are no less than 1,000,000,000,000,000 (one quadrillion) worlds whose chemicals make them habitable, estimates Dr. Harold C. Urey, famed University of Chicago chemist. Countless duplicates of our solar system may exist both in our own galaxy, the Milky Way, and in others like the spiral nebula pictured at right. While actual appearance of life may be a rare accident—even where all conditions are suitable—the odds against the Earth's being the only peopled planet are literally astronomical.

of life on Mars. Schiaparelli himself said: "Their being drawn with absolute geometrical precision, as if the work of rule or compass, has led some to see in them the work of intelligent human beings, inhabitants of the planet. I am very careful not to combat this supposition, which includes nothing impossible."

But his discovery set off sparks that caught fire in America. A rich, brilliant young American, Percival Lowell, read of Schiaparelli's findings. Scion of a remarkable New England family of poets, scholars and statesmen, Lowell had been graduated from Harvard with honors in 1876 and was preparing for a diplomatic career by traveling in the Far East when he heard about the *canali*. He decided to devote his fortune and talents to studying the planets, especially Mars.

Observatory Set Up to Solve Riddle

After investigating sites all over the world, Lowell founded his observatory at Flagstaff, Ariz., where the high, dry air promised a minimum of atmospheric disturbances. By 1894, when Mars was again close to the earth, he and his staff were making thousands of observations of the red planet. By the time of his death in 1916, Lowell probably had made more observations on Mars than any other astronomer.

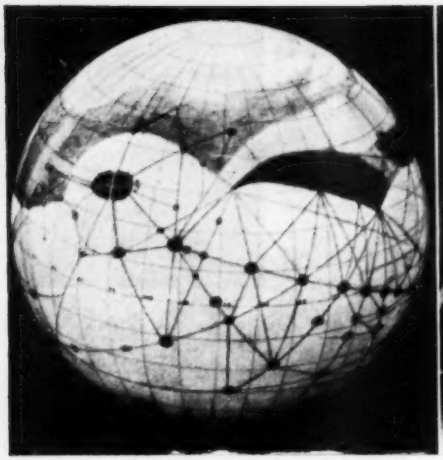
Where Schiaparelli had been doubtful about the canals, Lowell was positive. By 1909 his drawings showed the planet covered with an intricate geometric network of nearly 700 single and double canals. Nor was he shy about interpreting their meaning. "That Mars is inhabited," he said, "we have absolute proof."

To prove his point Lowell wrote three books, *Mars and Its Canals*, *Mars As the Abode of Life* and *The Evolution of Worlds*. His arguments were simple but fascinating.

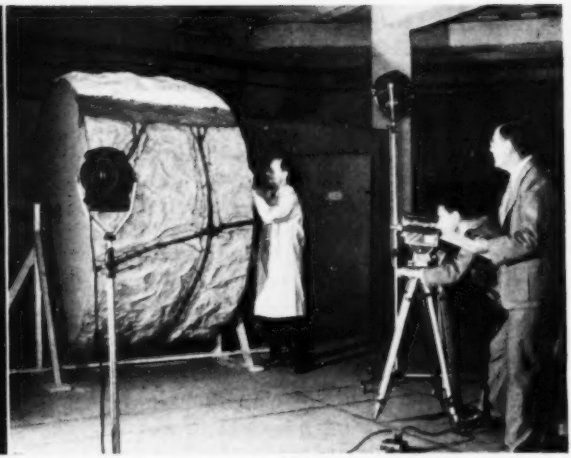
Mars, he believed, is a dying planet. Once the home of a thriving, highly intelligent civilization, the planet now is drying up. The light, ruddy areas of Mars are scorched deserts. Only at the polar caps is there much water left. In a desperate attempt to prolong the fertility of the planet, the Martians have constructed an enormous network of canals. These carry water from the frozen polar caps to the dark irrigated areas where the Martians live. To keep this enormous volume of water moving over tremendous distances, gigantic pumps with 4,000 times the power of Niagara Falls are necessary.

Why Canals Change Color

Lowell had a ready explanation, also, for the seasonal change of color of the canals and the dark areas. Since the smallest details a telescope can make visible on Mars are about 12 miles wide, the canals themselves, he thought, would be too narrow to be visible to astronomers here. What we actually see are belts of irrigated vegetation lining the canals, just as an observer on Mars might be able to see the fertile valleys lining our river banks. As the polar caps melt



DISPUTED "CANALS" of Mars are mapped in painting by Percival Lowell, who held them the work of intelligent beings. Others have suggested they may be fissures in crust.



MODEL made by American Museum of Natural History shows how canals may look at closer range. Movie of imaginary trip to Mars is being filmed for a planetarium show.

with the coming of the Martian summer, water is released to flow into the canals and the vegetation advances toward the equator with the moisture.

Lowell's theory set off a controversy that rages to this day. If Lowell were right, in his own words, "The drying up of the planet is certain to proceed until its surface can support no life at all. Slowly but surely time will snuff it out. When the last ember is extinguished, the planet will roll a dead world through space, its evolutionary career forever ended." And presumably the Martians, an intelligent race, would be feverishly hunting around for other planets to which they could migrate. The earth was the closest.

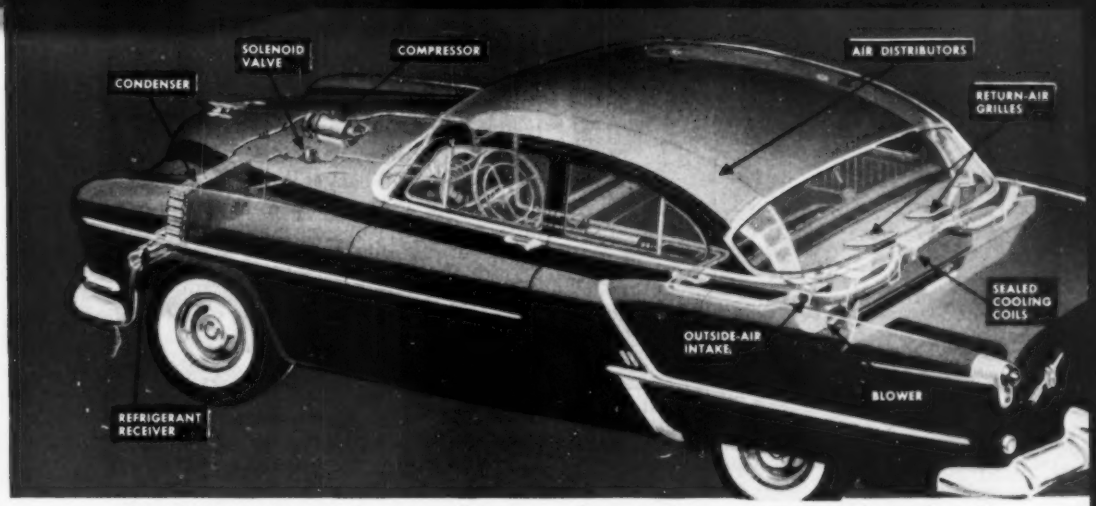
Cameras See the Invisible

Actually, what does modern astronomical science know about Mars? We know a great deal that Lowell could only guess at. The modern telescopic camera, for example, responds to haze-cutting infrared and short-wave ultraviolet light rays, thus "seeing" objects hidden to rays in the visible spectrum. Using these cameras, three cloud layers have been detected in the Martian atmosphere. The top stratum of bluish-white clouds, six to 19 miles above the surface of the planet, and a thin, continuous stratum of violet haze below it are believed to consist of fine ice crystals. The bottom layer, two to three miles high, consists of yellow clouds, which may be dust or sand stirred up by winds.

These clouds have long proved the existence of a Martian atmosphere, but now we can determine its approximate composition. Light passing through a mixture of gases will have certain of its component colors, different for each gas, absorbed. By analyzing the reflected light from Mars with a spectrograph, we find that the atmosphere has little or no oxygen. Carbon dioxide is the only gas thus far positively detected, although water vapor in small amounts is strongly inferred from the watery nature of the cloud layers and the polar caps. Nitrogen, which in observations of Mars would not show up on a spectrograph, is believed to be the major component of the Martian atmosphere—just as it makes up four-fifths of our own. The Martian atmosphere is very thin, about 1/15 as dense as ours and comparable to our high stratosphere about 13 miles up.

Lowell guessed that the bright, ruddy areas covering two-thirds of Mars were

[*Continued on page 260*]



HERE ARE THE PARTS of the air-conditioning system Frigidaire has built for Oldsmobile, shown as they are located on the moderately restyled 1953 Super 88 four-door sedan.

Refrigerator in Rear Cools New Oldsmobiles

Compact unit powerful as three window-size air conditioners does job . . . 1953 models also have 12-volt electrical system.

By Martin Loveland

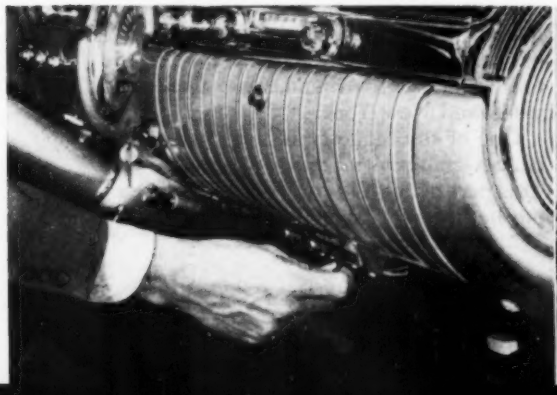
YOUR first glance at a 1953 Oldsmobile is likely to be a double-take. In the corners of the rear window you may see strange-looking objects that you have never seen on a car before—two horn-shaped ducts of clear plastic. They are practically the only visible signs that the car has been air-conditioned.

In any of its new closed models, Oldsmobile—for a few hundred dollars extra—will install an air-conditioning system.

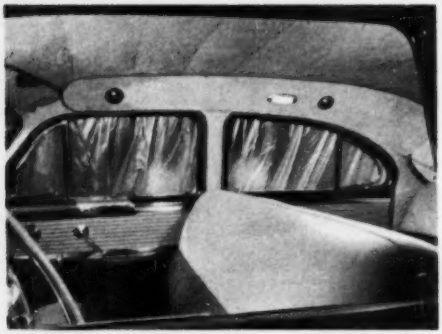
The plastic horns in the rear window carry cooled air from blowers down beneath the package shelf to long, flat, perforated distribution ducts between the roof and the tops of the doors on both sides of the interior of the car.

As a result, you can step into an air-

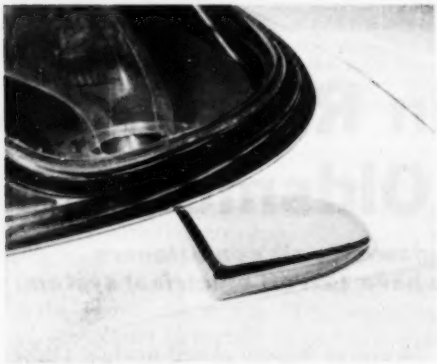
SLIDING REGULATOR for the air conditioner is under the glove compartment. Moving the lever left starts blowers and produces minimum cooling. It is moved right for "cold" air.



COMPLETELY SEALED refrigeration unit is at the back of the luggage compartment, taking up only a little space. Here the outside-air scoops are being shut off for winter driving.



TINY HOLES—1,500 of them—in the side ducts that distribute cooled air through the car prevent drafts. Airplane-type vents are for those who prefer the air to hit their faces.



ONLY VISIBLE SIGNS of air conditioning in an Olds are horn-shaped plastic ducts rising out of the package shelf, and side air scoops just below the rear window.

ANTIGLARE CRASH PAD made of plastic covering a base of foam rubber is an optional extra for the deck of the redesigned instrument panel. The pad is shown in place above.

conditioned Olds that has been parked for hours in the sun and whose interior heat hits you with a choking gush when you open a door, and within six blocks of driving the car will be 45 degrees cooler. By the time you have gone a mile or two, the inside temperature will be in the soothing 70s. If the day is humid, the moisture will also be squeezed out of the air in your car as it is being cooled.

Uses Only Four Horsepower

At a car speed of 39 miles an hour, the refrigerator gets rid of as much heat from inside the car as it would take to melt 1½ tons of ice. It does as much work as three average window-size air conditioners such as offices use.

Frigidaire, which first built an air-conditioning system for an automobile in 1937 and installed a gasoline engine in the trunk to run it, is making the Oldsmobile apparatus. This is a vastly improved system, which altogether weighs 280 pounds and circulates 300 cubic feet of air per minute inside a moving car. At a car speed of 50 miles an hour, on a very hot day, its compressor, belt-driven off the engine, consumes four horsepower.

A thermostat near the cooling coils, tucked away at the back of the luggage compartment, is normally set to keep the inside temperature between 69 and 71 degrees and the relative humidity in the comfortable area of 25 to 55 percent.

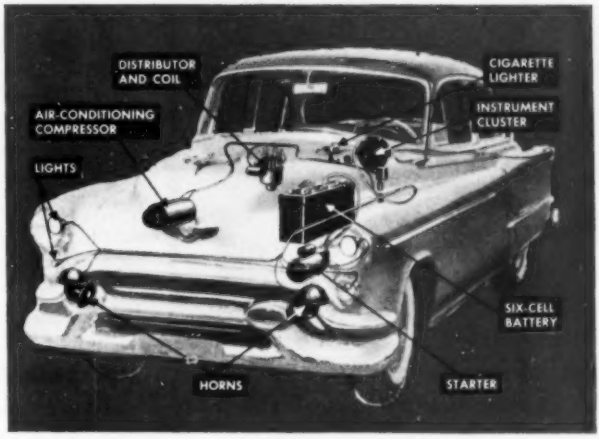
Took Three Years to Get It Right

Oldsmobile and Frigidaire engineers have been working out the design of this air-conditioning system for about three years. They have tested versions of it in the hot, humid weather of Tennessee, Georgia and Florida; in the hot, dry climate of Texas, Arizona and New Mexico; and in the heaviest traffic conditions to be found in Michigan, Ohio, Pennsylvania and New York.

One of the biggest problems was that of designing a satisfactory condenser. This part of the system, which dissipates the heat drawn from the interior of the

Why New Olds Has 12-Volt Battery

ADDING an air-conditioner was one load too many for Oldsmobile's old six-volt electrical system. So the company switched to a 12-volt battery. This meant changing over all electrical accessories shown at right. Also affected but not shown: generator, heater, radio, clock, Autronic-Eye headlight dimmer. Higher voltage, however, permits use of lighter wiring, saves copper.



car, is a grid of steel pipes and fins that had to be located in front of the regular radiator core. There it was likely to block the engine's supply of fresh air and cause the engine to overheat. In fact, the first condenser designed for the Oldsmobile caused the engine to boil in five minutes of idling and also every time the car climbed a sizable hill.

With the condenser finally achieved—three inches thick, 10 inches high, 21¾ inches wide and weighing 39 pounds—an air-conditioned Oldsmobile can idle for half an hour in 100-degree heat without causing its engine to boil.

With or without air conditioning, Oldsmobile's three 1953 lines provide changes in body styling, a wider choice of colors both outside and inside, and a new 12-volt electrical system. Power brakes and power steering are available at added cost.

The engine of the least expensive line, the De Luxe 88, has been boosted from 145 to 150 horsepower, its compression ratio raised from 7.5:1 to 8:1. The engine of the Super 88 and 98 has been boosted from 160 to 165 horsepower, with the same increase in compression ratio as the smaller engine has. END

FACTS ON '53 OLDSMOBILE

Model: Super 88 four-door sedan.
Engine: V-8 valve-in-head; 165 hp. at 3,600 r.p.m.; compression ratio, 8:1; piston displacement, 303.73 cu. in.; piston travel (in feet per car mile at 20 m.p.h.), 1,329; bore and stroke, 3¾" by 3 7/16"; crankshaft bearing surface, 73.9 sq. in.; torque, 284 lb.-ft. at 1,800 r.p.m.
Weight: 3,704 lb.; per hp., 22.45 lb.
Transmission: Hydra-Matic; rear-axle ratio, 3.23:1.
Steering ratio: 21.3:1; radius of turning circle, 21.25'.
Effective brake-lining area: 191.7 sq. in.
Springs: front, coil; rear, leaf.

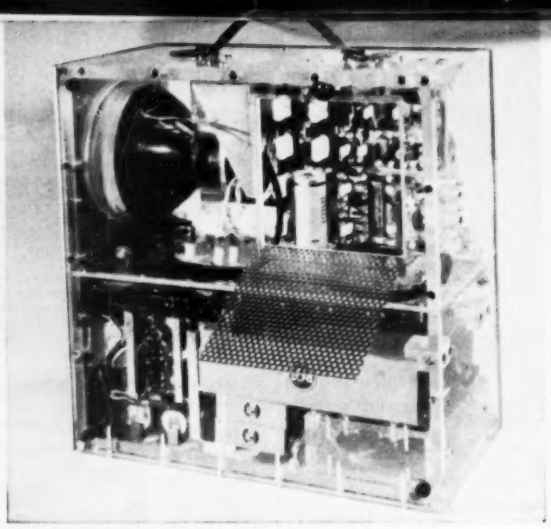
Outside dimensions: height, 63.63"; overall length with bumpers and guards, 203.15"; width, 76.94"; wheelbase, 120"; overhang, front 34.50", rear 48.65"; tread, front 59", rear 59".

Inside dimensions: seat-cushion width, front 63.08"; rear 64.24"; leg room, front 42.66", rear 43.32"; headroom, front 35.38", rear 34.95"; seat height, front 13.68", rear 12.45"; vertical distance, steering wheel to seat cushion with seat in mid-position, 4.90"; front-seat adjustment, horizontal 4.40", vertical .34".

Tire size: 7.60 by 15.

Sweat Box Is Icebox, Too

GUIDED-MISSILE parts get either a hot foot or a cold shoulder in this test chamber. With electric heaters turned on, temperature climbs to 250°. But it drops fast to 100° below when a solution of alcohol cooled by liquid carbon dioxide is circulated. The rapid temperature change lets Northrop engineers run many tests a day.



Portable TV Weighs 27 Pounds

THIS experimental battery-operated TV set uses transistors and has no tubes except the five-inch picture tube. During tests of the single-channel receiver, a built-in loop antenna brought in satisfactory pictures five miles from the nearest TV tower. Addition of a "rabbit-ear" antenna to the RCA set increased its range to 15 miles.

They Say Now.....

"The engineer—by the deadly efficiency of the machines he has created—may actually have contributed to the outlawing of war."—COL. E. R. HEIBERG, U.S. MILITARY ACADEMY.

"The upper limit of age predetermined by our species has never been reached by a majority or even by a considerable minority of individuals."—DRS. RAPHAEL GINZBERG AND V. OLSVARY, MENTAL HEALTH INSTITUTE, CHEROKEE, IOWA.

"[Someday] we will raise our fuel just as we did when we used horses. One acre ought to run an automobile for a year."—CHARLES F. KETTERING, GENERAL MOTORS.

You Spray on This Bandage

A PLASTIC surgical dressing that can be sprayed on has been developed by the Air Force. Called Aeroplast, it is applied in a coating about five thousandths of an inch thick. During healing, the burn or wound under the transparent dressing can be inspected at a glance and, if necessary, the plastic can be peeled off without injuring the wound. It adheres only to dry, healthy skin areas.

Parking Wheel Rolls Car Sideways into Tight Spots

THE old saw about a "fifth wheel" may soon lose its punch. The car above sidles its way into a tight spot in a few seconds on wheel number five, the spare. The car is nosed toward the curb, and a control lowers the extra wheel hydraulically from the trunk. It raises the rear of the car, then rolls it crabwise to the curb. Brooks Walker, San Francisco inventor of the Parccar, hopes to sell it to auto makers.

Pen Has Jewel Point

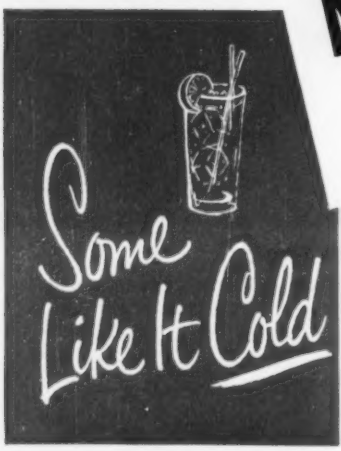
YOU write with sapphire when you write with this pen. A tiny synthetic gem, machined until it is off-round less than one two-millionths of an inch, forms the ball point. Sapphire is said to have a special affinity for ink so the liquid flows over it more evenly than over a steel or other metal ball. The pen is made by Waterman.

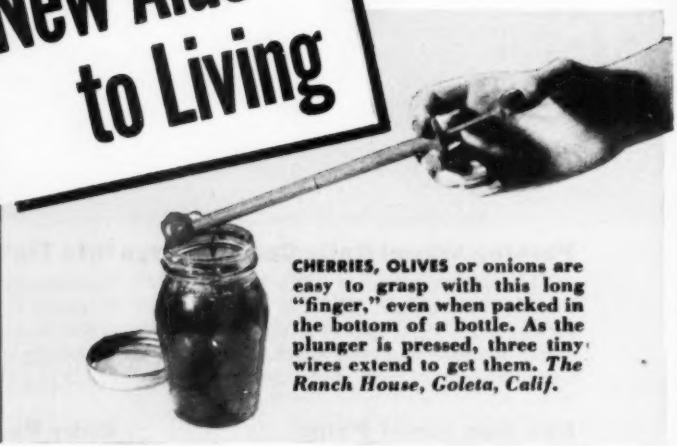
Baby Porkers Get Milk on Tap

THESE five-week-old piglets never miss their absent mama. A 14-tap heated feeder supplies them with milk and added nutrients. John Percy, an English pig breeder, designed it to wean baby pigs from the sow after two days instead of eight weeks. British farmers hope it will increase the pork-chop and bacon output in England.

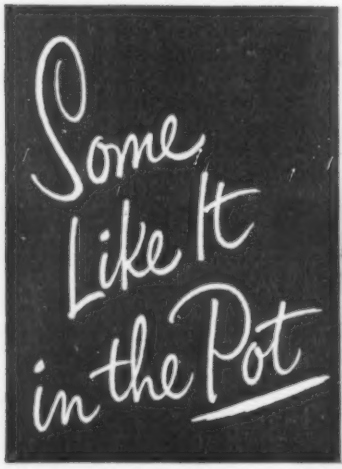
New Aids to Living

DRIP COFFEE stays hot in this electric coffee maker. During brewing, water stays in top unit (not shown) until it reaches right heat for good coffee flavor. *Dulane Inc., River Grove, Ill.*





CHERRIES, OLIVES or onions are easy to grasp with this long "finger," even when packed in the bottom of a bottle. As the plunger is pressed, three tiny wires extend to get them. *The Ranch House, Goleta, Calif.*



SOUP STAYS HOT for hearty second helpings when made in electric cooker, which plugs in at the table. It also deep-fries, turns out casseroles, steams food, pops corn or heats the rolls. *Sunbeam Corp., Chicago.*

A CRADLE for your coffee maker, this coffee butler makes pouring easy. Alcohol burner keeps brew hot. *JSM Associates, NYC.*

TEA BREWS in removable infuser, stays hot an hour in insulated teapot. *Teamakers, Inc., Chicago.*

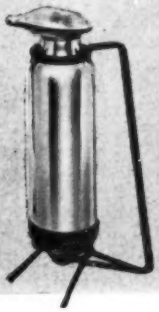
COFFEE FOR 24 can be perked in this electric urn. *La Belle Silver Co., Glendale, N. Y.*

FROZEN DRINKS and frappes are set up in jig time with ice plane below. Just shave it across ice frozen in a tray without dividers. *Miles Kimball Co., Oshkosh, Wis.*

WINE CORKS yield fast to this tool. Top handle engages cork, lower one eases it out whole. *Louis Dups, Inc., NYC.*

GLASSES, beer cans or pop bottles all nest securely in these rubber coasters. The starlike prongs hug the container tightly. *House of Bertram, Scarsdale, N. Y.*

HOT MILK at bedtime or cold drinks on the terrace will hold their temperature in a vacuum-bottle drink caddy. *Wiederspan & Mohr, Denver.*

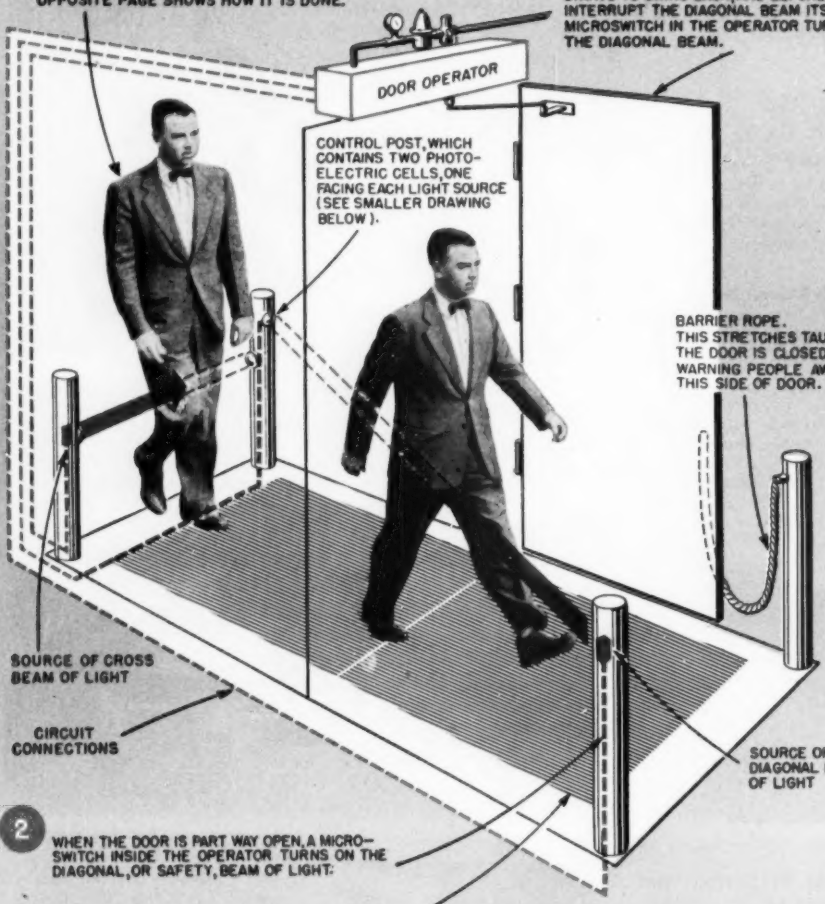


EGGS SEPARATE cleanly in a special cup. Yolks sit on lid well, whites drip through slots into the cup below. *Ett-Barr Co., Pasadena, Calif.*

ANY SCREW-CAP BOTTLE will give up meekly when gripped with this rubber cap remover. *Universal Sales Co., Portland 13, Ore.*

1 WHEN A PERSON INTERCEPTS THE CROSS BEAM OF LIGHT, A RELAY IN THE DOOR OPERATOR CAUSES THE DOOR TO OPEN TO ITS FULLEST EXTENT. THE DRAWING ON THE OPPOSITE PAGE SHOWS HOW IT IS DONE.

3 THE DOOR REMAINS OPEN AS LONG AS THE DIAGONAL BEAM OF LIGHT IS INTERRUPTED. WHEN THE BEAM IS NO LONGER INTERRUPTED, THE DOOR BEGINS TO CLOSE. AS THE DOOR STARTS TO SWING BACK, AND BEFORE IT CAN INTERRUPT THE DIAGONAL BEAM ITSELF, A MICROSWITCH IN THE OPERATOR TURNS OFF THE DIAGONAL BEAM.



CONTROL POST, WHICH CONTAINS TWO PHOTO-ELECTRIC CELLS, ONE FACING EACH LIGHT SOURCE (SEE SMALLER DRAWING BELOW).

BARRIER ROPE. THIS STRETCHES TAUT WHEN THE DOOR IS CLOSED, THUS WARNING PEOPLE AWAY FROM THIS SIDE OF DOOR.

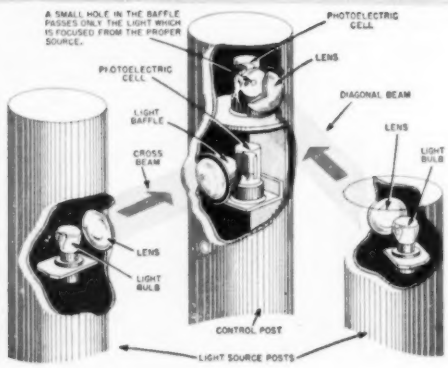
SOURCE OF CROSS BEAM OF LIGHT

CIRCUIT CONNECTIONS

SOURCE OF DIAGONAL BEAM OF LIGHT

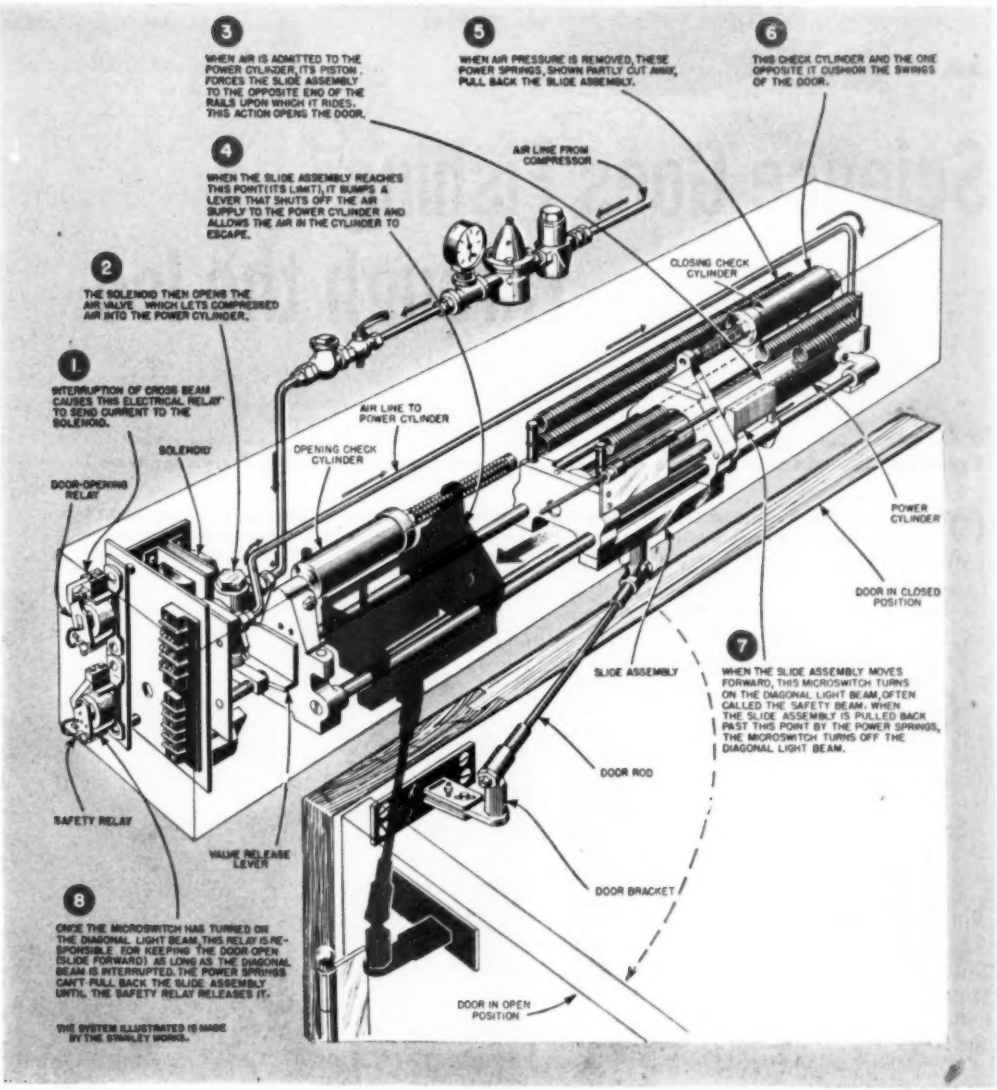
2 WHEN THE DOOR IS PART WAY OPEN, A MICRO-SWITCH INSIDE THE OPERATOR TURNS ON THE DIAGONAL, OR SAFETY, BEAM OF LIGHT.

AN ALTERNATE CONTROL SYSTEM FOR THE DOOR OPERATOR IS A PAIR OF VINYL PLASTIC CARPETS CONTAINING ELECTRIC-CONTACT SHEETS. STEPPING ON THE "OPENING" CARPET CAUSES THE OPERATOR TO OPEN THE DOOR. THE DOOR STAYS OPEN WHILE THE PERSON IS CROSSING THE SECOND, OR "SAFETY", CARPET.



How an Electric-Eye Door Works

MECHANICS OF LIVING



Science Goes Fishing Through the Ice

Expedition flew to Labrador, used helicopter and ski-equipped lightplane to ferry supplies.

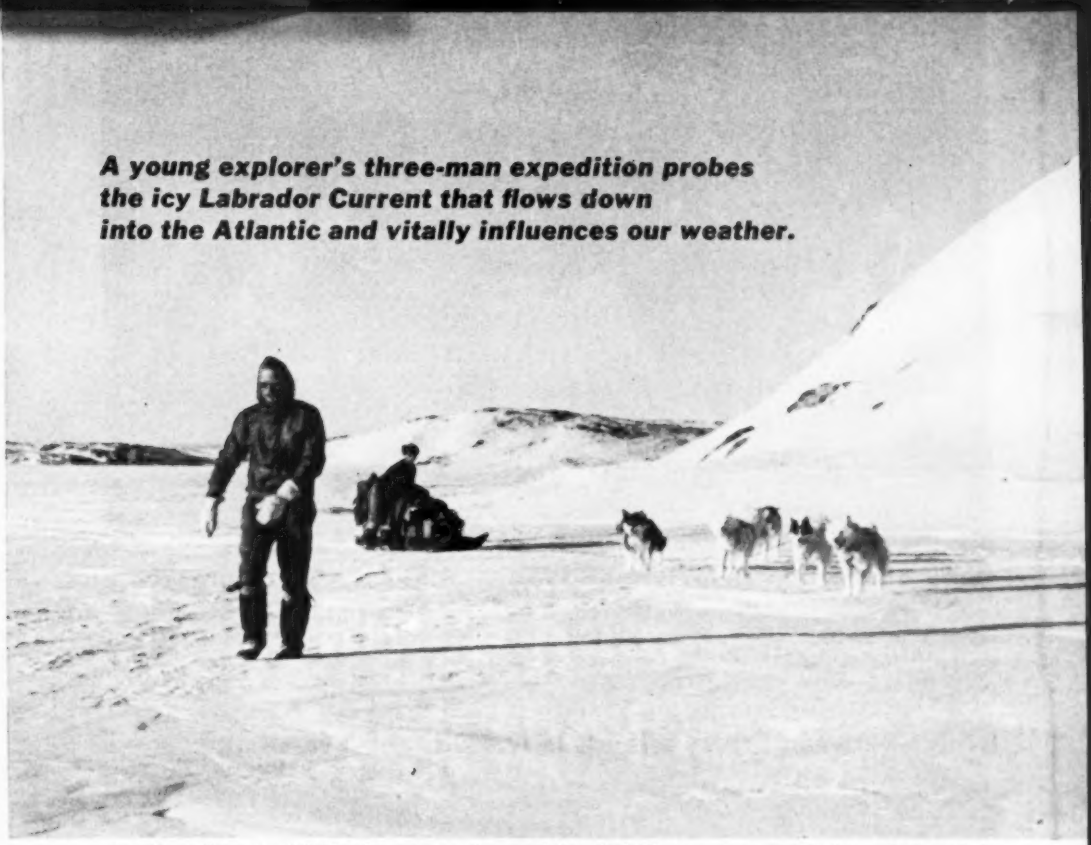
ONE reason the Northeast's winters are so rugged is an icy river in the ocean—the Labrador Current, which streams down between Greenland and Baffin Island to strike the warm Gulf Stream below Newfoundland and divert it eastward.

Weather scientists now know more about the Current because three men went "ice fishing" on Lake Melville, a salt-water tidal lake in Labrador, last winter. Their lines bore no hooks, but lowered through holes in the ice instruments like bathythermographs, Nansen bottles and thermometers. Instead of fish they brought back water samples and data on deep-sea temperatures, saltiness and oxygen content. Their findings are expected to help trace the Current's course and thus explain more of its effect on our weather.

Headed by 32-year-old Cmdr. David C. Nutt, USNR, of the Dartmouth College Museum, the expedition included assistant John Tangerman and guide Harvey Montague. Data went to Office of Naval Research.

FIRST STEP in setting up the oceanographic station was cutting ice hole through which scientists went "fishing." Below, Montague wields chisel as Commander Nutt skims off slush.

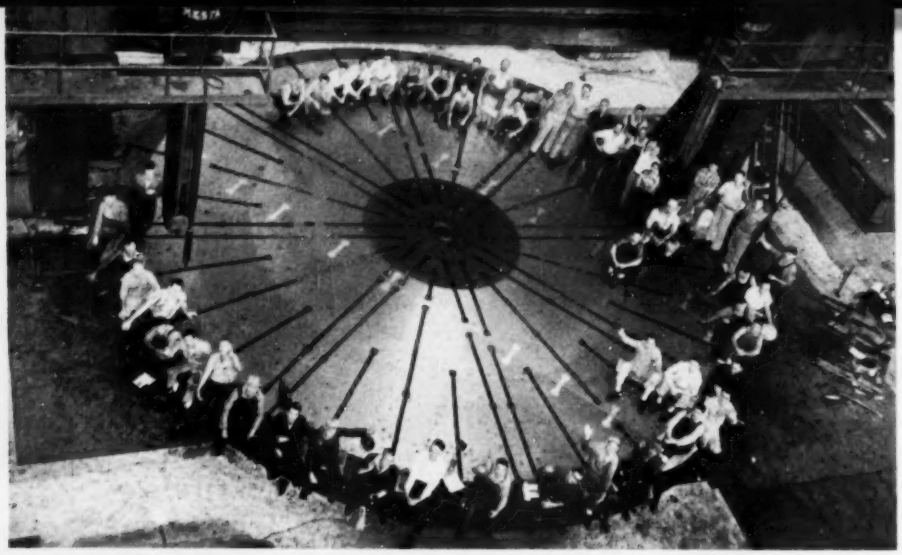
A young explorer's three-man expedition probes the icy Labrador Current that flows down into the Atlantic and vitally influences our weather.



Last leg of trip to "fishing" spots on frozen Lake Melville required old-fashioned dog sled.

PYRAMIDAL TENT FRAME served as derrick to lower instruments more than 600 feet below the ice. Tangerman is reading thermometer on Nansen bottle containing water samples.

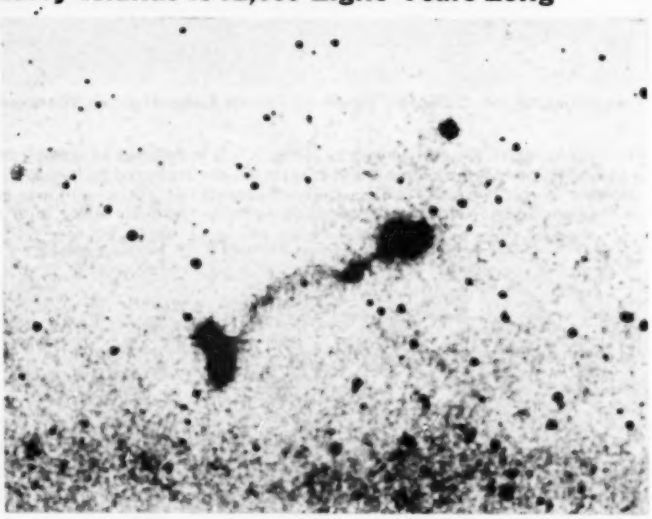
DURING EXTREME COLD the work went on inside covered tent heated by a small gasoline stove. At night, tent was moved away from ice hole and the three men slept in it.



Huge Boring Mill Helped Build World's Biggest Air Compressor

ANCHORED to a 16-foot-thick block of concrete, this boring mill measures 40 feet across. It was used at the Westinghouse plant in Sunnyvale, Calif., to shape giant slabs of steel into the largest piece of rotating equipment ever made—an air compressor for the U. S. Air Force wind tunnel at Tullahoma, Tenn.

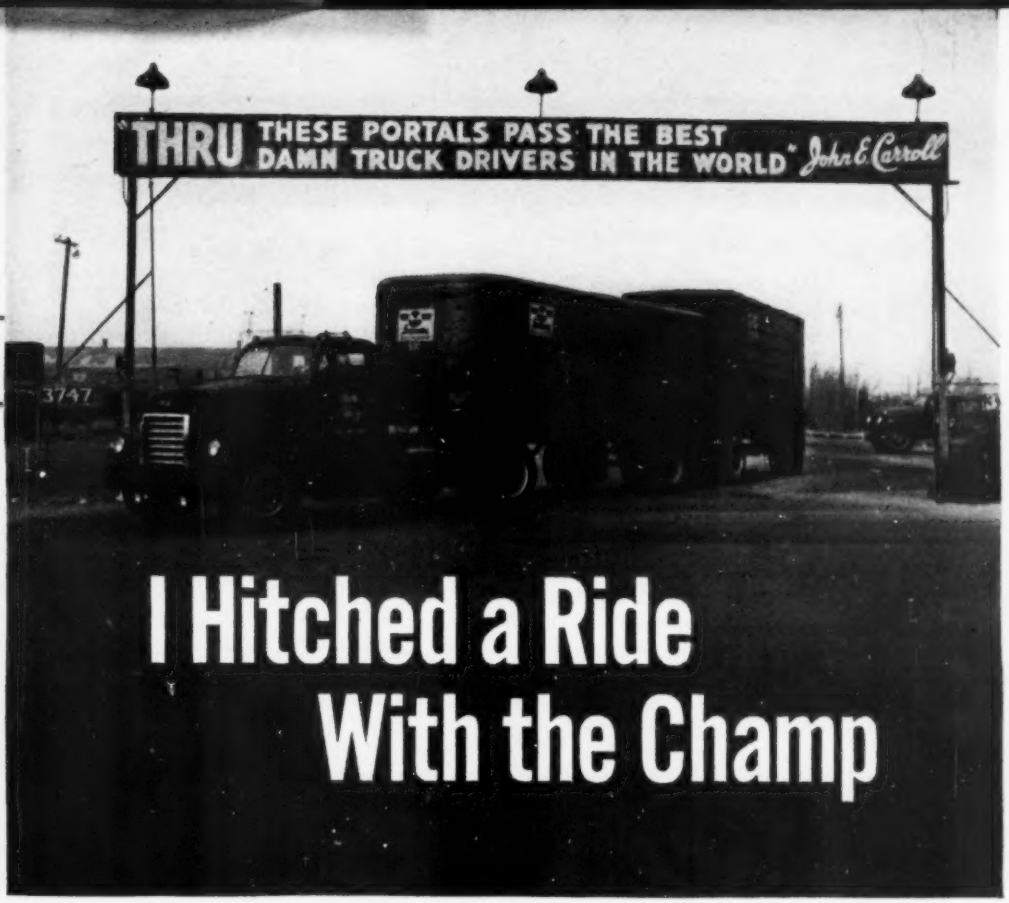
Bridge Between Starry Islands Is 72,000 Light-Years Long



ASTRONOMERS have known for years that galaxies other than our Milky Way—they call them "extragalactic nebulae"—are sometimes close enough together to be linked by luminous filaments, like the bars of dumbbells. But recently, luminous bridges many thousand million million miles long have been photographed at Caltech's Palomar Observatory.

One of the largest yet discovered is shown here. Extending between three nebulae, some 50 million light-years from the earth, the upper and shorter part of the span, which is straight, is as clearly defined as a brightly lit boulevard. The lower section is less distinct and takes the form of an arch. Astronomers are not sure what formed these light bridges but one theory is that the three nebulae may be rotating around or passing one another, creating a disturbance which causes them to eject stars and other matter into the space around them.

They speculate, too, on the possibility that a similar bridge may link our Milky Way with the Large Magellanic Cloud, or Nubecula Major.



I Hitched a Ride With the Champ

A day's run with the "best" U.S. driver of the biggest trucks shows that a skilled hand at the wheel is also a cautious one.

By Andrew R. Boone

I CLIMBED into the cab of a gleaming red GMC 200-horsepower Diesel tractor early one morning recently for a fast run down the coast from Los Angeles to San Diego. Behind were hooked two full trailers loaded with refrigerators, washing machines and hardware for a store 120 miles away. At the wheel was 41-year-old, six-foot-two Harry Naylor, who has driven trucks 1,000,000 miles.

Naylor is a champion. Last October in New York, he won national top honors in the truck-full-trailer class at the annual Truck Roadeo, a grueling test of driving skill staged by the American Trucking Associations. Twenty-five years ago, at 16, he learned to drive a Model T pick-up. Now he drives anything that rolls, but especially the biggest truck-trailer combos the law allows. In California that means 60 feet in

Trophy won by Harry Naylor.

SCENES FROM A DAY'S WORK in a champion's life (facing page). Top: shifting gears; bottom left: "refueling"; center: uncoupling trailer; right: checking tires.

length and 78,000 pounds in weight.

On this morning I was hitching a ride with Naylor to find out what makes the champion of the big rigs tick.

It was 5:30 when he fired up the Diesel. A buzzer warned that air pressure for the brakes wasn't up.

"Better watch the tachometer, not the speedometer," Naylor advised me. "We'll drive at 1,950 r.p.m. That's the most efficient speed."

As the engine warmed up, Naylor went around and kicked each of the 16 trailer tires. All thumped alive—no flats. He's especially tire-conscious. Friction from a flat turning at high speed once set afire two tires and part of a trailer he was hauling. Another time a rim thrown by a blown-out tire caused trouble.

At 5:40 we moved out. As the outfit began to roll, Naylor started playing a tattoo with the gears. Two levers provide 15 forward speeds. One shifts five gears, the other moves between "under," "direct" and "overdrive." Keeping the proper ratio for speed and road conditions is a tricky business, and Naylor was to shift several hundred times by mid-afternoon.

Getting the rig under way seemed easy as I watched him hitting the clutch and moving the levers. In fourth direct we eased along city streets. He slowed to catch a green light in third overdrive. Through the gears he raced into fifth overdrive as we picked up 45 miles an hour on open highway.

Occasionally I glanced at the tach. It never showed more than 2,000 revolutions per minute, no matter whether Naylor dropped down two gears to take a hill or was descending a grade.

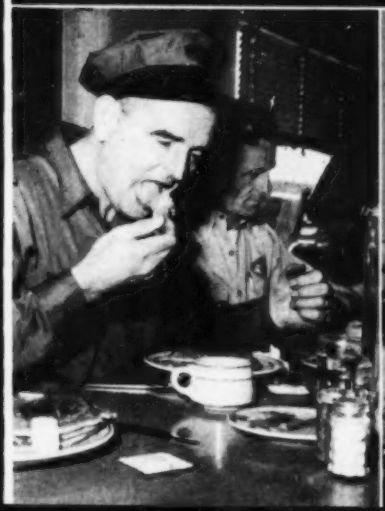
At 9:30 we swung into a lot in San Diego and dropped the end trailer. We delivered the first unit to a warehouse further on. Two freshly loaded trailers were waiting for us when we returned to the lot on the way home.

"I get a different run nearly every day," Naylor explained to me, between shifts. "Maybe to Santa Barbara, Bakersfield, the harbor or San Diego. Every morning the boss and some shipper entrust me with a $25,000 truck and a $50,000 load."

Naylor has had but one serious accident—a head-on collision during the war with another combo that suddenly pulled into his lane. Since then he has driven 350,000 miles without a mishap.

The Master Driver's Road Work Rules

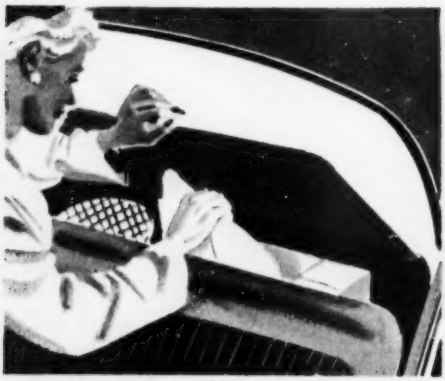
- **Be courteous at all times. Never insist on having the right of way.**
- **Keep your mind on your driving. If you want to enjoy the scenery, park.**
- **Signal every turn, if only from one lane to another.**
- **Stay far enough behind the car ahead so that you can stop no matter what the other driver may do.**
- **Keep your car in good mechanical shape. Frequent checks can prevent accidents that could be serious.**
- **Consider every school child a potential stop sign—and stop if a youngster seems about to wander onto the road.**
- **Slow down at sundown. This is one of the most important rules. After dark, never over-drive your headlights.**
- **Stay within legal speed limits. Drive slower in traffic and bad weather.**
- **Always use good tires and keep them inflated properly.**
- **Stop at stop signs. Don't roll slowly through. You might not see a car speeding through the intersection.**
- **Never pass a car on a curve or a hill. You can't accelerate fast enough to duck trouble, and maybe the oncoming driver's brakes are faulty. If you don't kill him, he may get you.**



I'd Like to see them make...

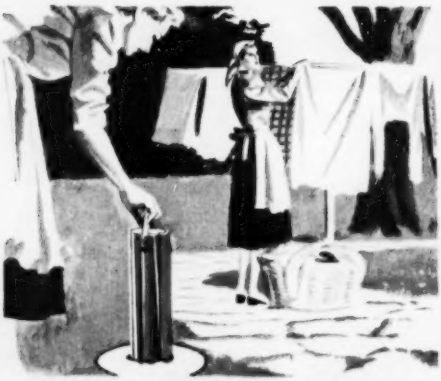
Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science Monthly* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

A CLEAR-PLASTIC RURAL MAILBOX. The postman could tell at a glance if there was mail to be picked up, and owner could see incoming mail.—*Mrs. H. Spence-Thomas, Brewster, N.Y.*



A STORAGE BIN to utilize the space under the shelf behind the back seat. This would relieve the crowding in the car's glove compartment. —*Joe Randolph, Greenville, Tex.*

A MUSIC STAND with a spindle at each end. The music, printed in rolls, would be mounted on the spindles and moved along by means of a foot pedal.—*Burton Unger, Brooklyn.*



A COLLAPSIBLE CLOTHESLINE POLE that would telescope into a container sunk into the ground, for out-of-the-way storage when not in use.—*David E. Mann Jr., Cheltenham, Pa.*

AN AUTO ALARM CLOCK to enable a drowsy driver to pull off the road and take a little snooze without fear of oversleeping and missing an appointment.—*A. V. Khan, Toledo.*

Giant Turbo Engines Power Navy Connie

FOUR 3,200-horsepower turbo-compound engines give this Super Constellation a top speed of 400 miles an hour. Cruising at 340, it can span the Atlantic in less than nine hours. Although the Navy has top priority, similar turbo-powered planes will soon go to nine civilian airlines. Some of the civilian jobs will have plush interiors like the muraled compartment, designed by Henry Dreyfuss, shown in mock-up at right.

French Minijet Cruises at 225

DESIGNED for liaison jobs and primary flight training, the all-metal, two-place midget shown below is claimed to be the first plane of its kind to be powered by a jet engine. On its first test flight near Paris the Sipa 200 Minijet cruised at 225 miles an hour. It is 17 feet long, has a wingspread of 23 feet, and is equipped with retractable tricycle landing gear.

Turboprop for Small Planes, Too

THE world's first turboprop light plane is what Cessna calls its new version of the L-19 "Bird Dog," widely used in Korea. A 250-pound Boeing gas turbine has elbowed out the old six-cylinder piston engine, slicing 125 pounds off the plane's weight. It is quiet, vibration-free, and burns Diesel fuel. The arrow points out one of the turbine exhaust pipes.

His Bike Runs

It goes like a house afire

SMOKE gets in your eyes when you drive this three-wheel steam bike. But to make up for that, you don't buy a thing at gas stations. Free water, a hatchet and a well wooded countryside are all you need. You chop your fuel as you go, and if there are no trees around, a fence post will take you a few miles.

Anton Bohaboy of Rahway, N. J., well known as a builder of small steam boilers and engines, made the machine on a bet. When a friend stated that steam plants could not be applied to small vehicles, Bohaboy laid down his money and picked up his tools. He won the bet.

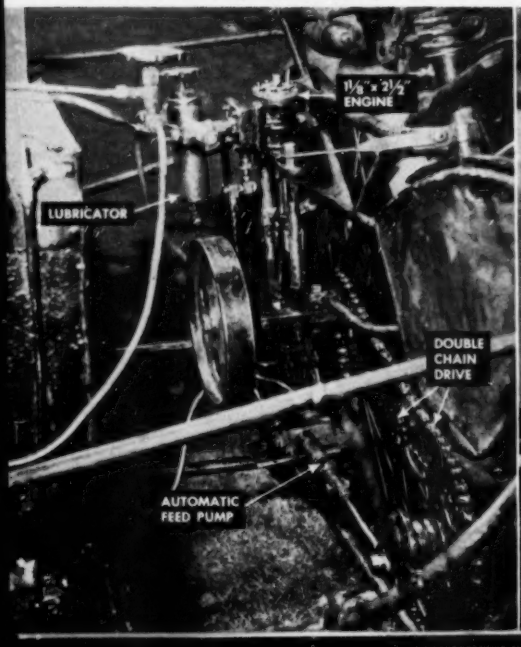
To provide room for the boiler and water tank (and incidentally to avoid sitting over a hot chimney), Bohaboy added a third wheel. The boiler, of his own design, supplies steam at 120 to 180 pounds' pressure. Timed by a POPULAR SCIENCE MONTHLY reporter, it got up 40 pounds of pressure from a cold start in five minutes—enough for the bike to be walked under its own power—and a head of 120 pounds in eight minutes from firing up. Firewood is carried in a box under the upper frame bar.

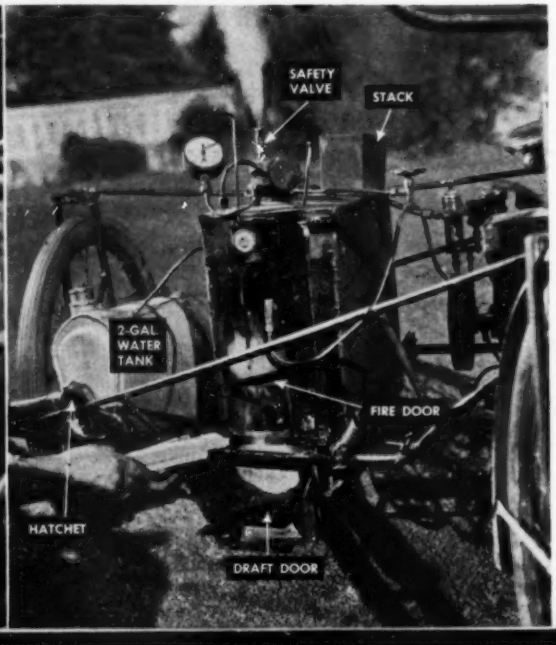
A chain from the one-cylinder engine drives what was originally the pedal shaft, and a second chain from this drives the rear wheel, the total reduction being one to 10.

Water is fed into the boiler while the bike runs by a pump driven off the jackshaft. A hand pump is provided for use when standing, or if the power pump should fail. To prevent flooding the boiler by the automatic pump, a manual bypass is provided.

ONE-CYLINDER POWER PLANT is a double-acting slide-valve engine of only 1⅛″ bore and 2½″ stroke, driving the rear wheels through a 1-to-10 reduction. A displacement lubricator in the steam line supplies oil to the cylinder. Power feed pump keeps up water level.

ALL-STEEL BOILER consists of a 3″ diameter steam drum with a dome at the top and a 1½″ mud drum at the bottom, connected by 70 tubes. Tested to 1,200 pounds' cold-water pressure, it's housed in boxlike casing. Draft door can be set from handlebars.



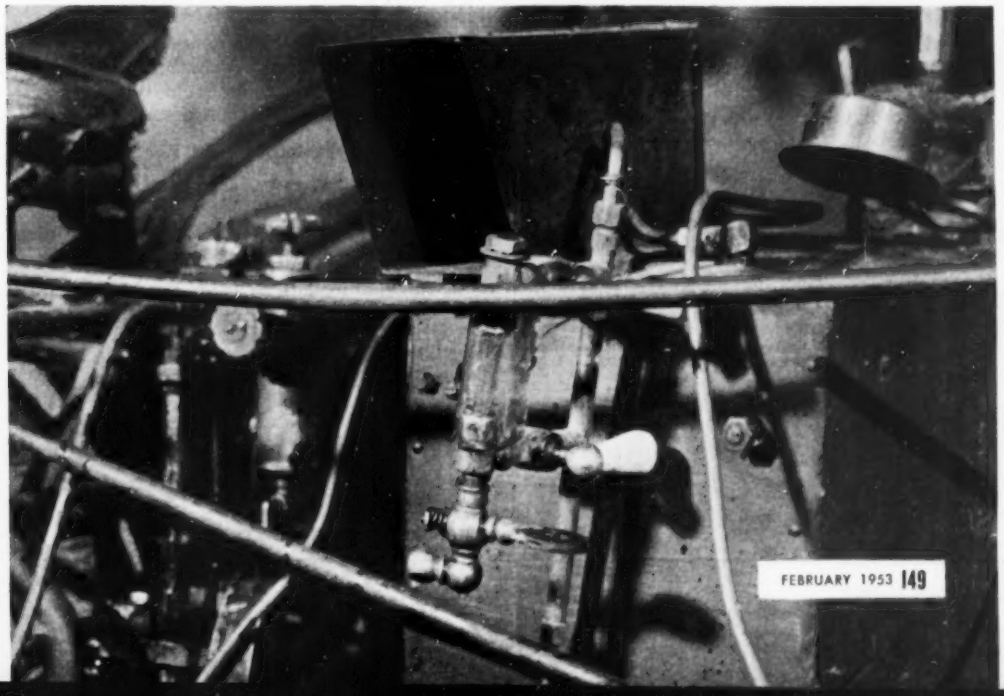


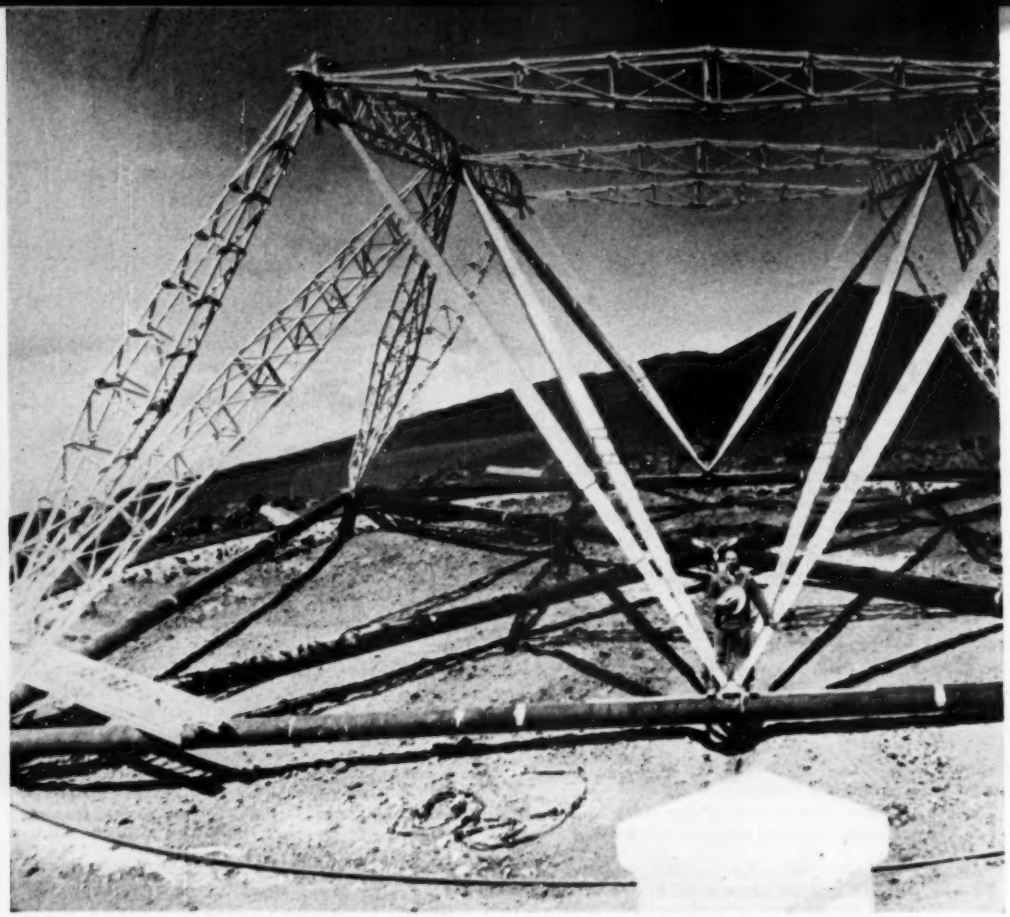
On Firewood

and he gets 18 miles on a bushel.

FLAMES SHOOT OUT of the stack and a plume of white exhaust steam trails behind as Anton Bohaboy guns his wood-burning bike. Its tiny engine gives it a top speed of about 20 m.p.h.

WATER GAUGE at rear of boiler is glass-tube type, protected by a shield of clear plastic. The rectangular hood on top of the boiler casing, facing backwards, is chimney stack.





Bridgelike Radio Telescope Probes Hawaiian Skies for Sources

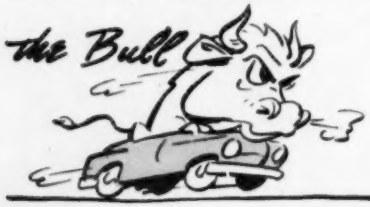
WHERE does cosmic static come from? To find out, scientist Grote Reber has set up a framework of tubes and trusses at the summit of a 10,000-foot dormant volcano on the Hawaiian island of Maui. There he will use it to pick up the strange signals, not only directly from the sky but from the surface of the surrounding sea, which bounces

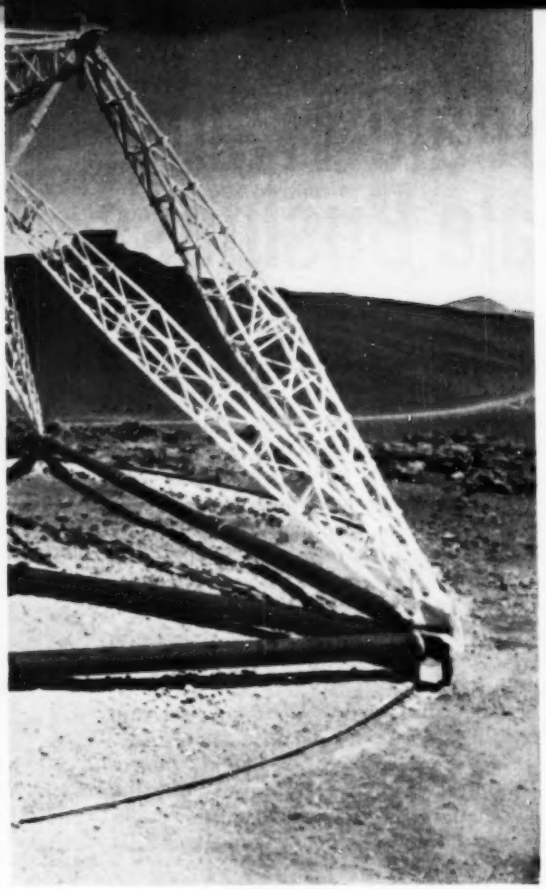
Highway 100

Have You Met These

SURE, YOU KNOW HIM by his twin horns. He's the bulldozing type who puts his head down, glares at one and all, and says: "Get lost, buster; I'm coming through."

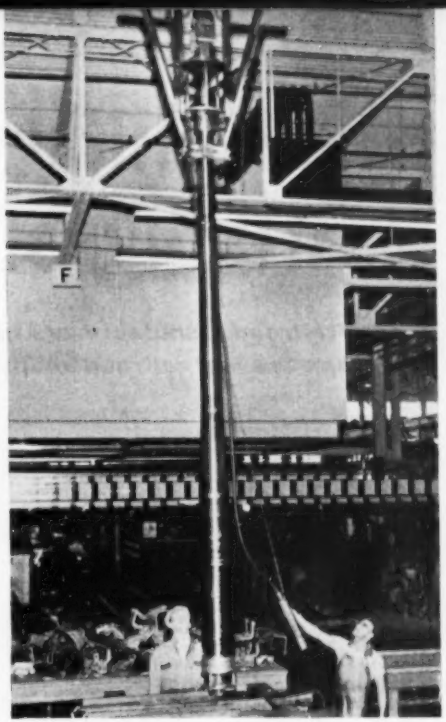
THE 70-MILE-AN-HOUR DEMON, that's now-you-see-him, now-you-don't Harvey, who passes you like you were standing still. You figure he'll be in Kokomo in half an hour, but 15 minutes later you pass his car pulled up—you've guessed it—where Harvey can take another quick one "for the road."





of Mysterious Cosmic Static

them back like a giant reflector. By timing and measuring the two sets of impulses, he hopes to localize their source and learn what forces create them.



Plated Gun Barrels Last Longer

You don't see the mirror-smooth plating on Uncle Sam's 90-mm. tank-gun barrels when they are hoisted out of this 30-foot-deep solution tank in the Oldsmobile Gun Plant at Lansing, Mich. It is all on the inside, applied by a specially fitted anode which accurately controls the uniformity of the electrolytic deposit. The gleaming metal lining resists wear better than an untreated surface, adding to the life of the rifling grooves.

Wild Animals at Large Lately?

THIS CHEST-THUMPING CHARACTER makes with a big fat sneer when you tell him it took you half an hour to get from here to there. "What held you up?" he yelps. "Backward or something? I made the same trip last week, stopped for lunch, and it took me only 13 minutes."

THEN THERE'S THE VICIOUS TYPE—the snarler who hates everybody on the road, and most of all, you. He fancies himself the world's one and only hep driver. National Safety Council's *Public Safety* magazine asks motorists to study this menagerie. Any chance of a throwback in your driving?

Their Small-Scale Trains Are Big-Scale Business

Model-railroad manufacturers turn out more equipment than the real railroad shops to keep 200,000 hobbyists happy.

By Robert Hertzberg

THE men who make the parts for the little trains that speed in tight circles over more than 38,000 scale miles of track in 200,000 homes are definitely in big business. They have found that the average scale-minded rail fan, who prefers to assemble his tiny trains himself instead of buying them ready-made, is willing to spend more than a week's salary a year on his miniature transportation system. Their tiny trains, as a result, have become a million-dollar-a-year industry.

That's one to tell the little woman when she finds that you've spent the Venetian-blind money on a three-unit Diesel kit. She'll probably put a reverse twist on it: your hobby is making a fortune, all right—in somebody else's pocket.

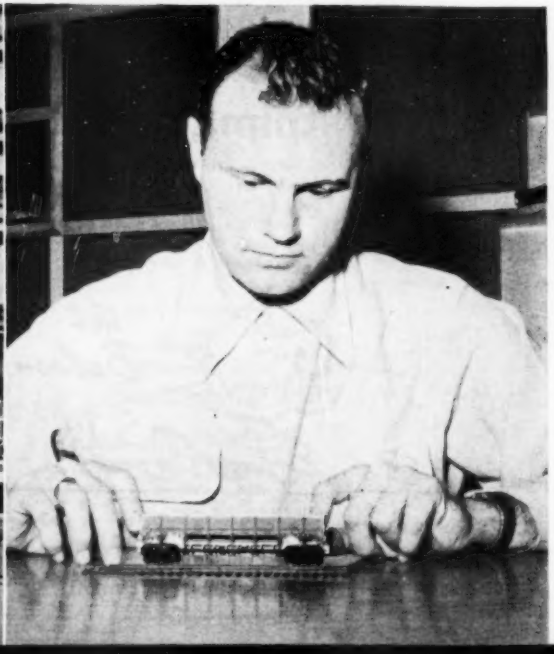
While that's true, it's also true that hobby-to-career stories are the rule rather than the exception. Nearly all of today's manufacturers rode into business on their own iron hobbyhorses.

One top-flight maker of table-top train equipment, Gordon Varney, recalls with nostalgia his introduction to model railroading as a hobby back in 1936.

"Where else," he asks, "could you get 10 hours' worth of entertainment for the two-dollar bill invested in a freight-car construction kit? The trouble was that

THE MODELER who made Milwaukee famous, William Walthers, whose assembly-kit business grossed $100,000 last year, believes that interest in steam-type models is dying out.

DESIGNING AIRPLANE BOMB BAYS didn't appeal to Californian C. J. Ulrich. So he put eight working dump doors in this little gondola car, sold 14,000 like it in three months.



after I had put a dozen of these kits together I looked at my wife and we said to each other: 'There should be a business here.'

"That was when a perfectly good hobby went out of the window. We soon found that there is no such thing as a hobby-business. To pay off, it has to be your business and the other fellow's hobby.

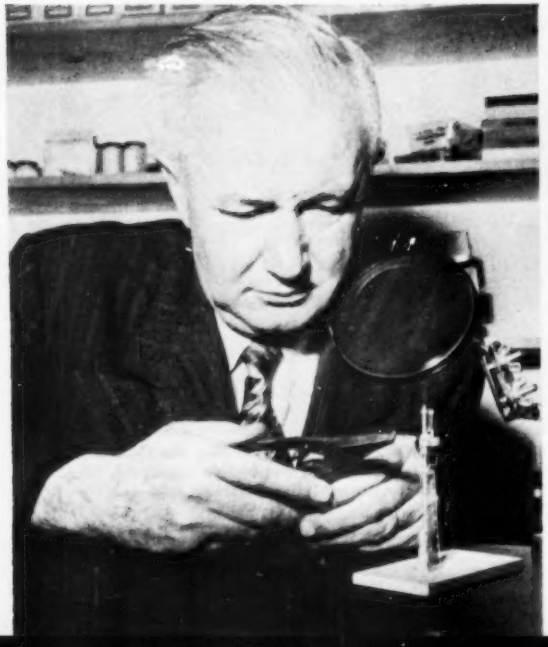
Models Outnumber Real Ones

Today the Varneys operate two trim, glass-walled plants, one in Coral Gables, Fla., and the other in Puerto Rico. They employ more than 50 full-time craftsmen, and together the two shops turn out more locomotives and cars than Baldwin and Pullman-Standard combined.

If Varney is the Baldwin among model-railroad builders, John N. Tyler of Woodbury Heights, N. J., is the American Locomotive Works. Tyler has ridden his hobby commercially for more than 20 years.

He didn't plan it that way. A marine and electrical engineer who had traveled all over the world in the Twenties, he finally went to work for an oil company

A CLERGYMAN with a reverence for fine workmanship. Albert Kurtz Sr. is shown here putting a grain-of-wheat lamp in an HO-gauge semaphore designed by his son.



BIG WHEEL of Mantua Metal Products Co., which does a million-dollar business in little engines and cars, is John N. Tyler. His locomotives range in price from less than $10 for the side-tank switcher in the foreground to $50 for a big road hog. High-speed injection machines, punch presses and screw machines turn out low-cost, quantity-produced items that are actually better than handmade models.

in a small south Jersey town. O gauge was just getting well under way then, and with a native-born Englishman's love of model railways, Tyler went for the hobby in a big way. To finance his elaborate layout, he spent evenings and week ends making electrically driven models of boats for yachtsmen who cruised the nearby Delaware River.

Tiny Trains Need Tiny Motors

In 1932, an overseas friend showed Tyler a new kind of locomotive model. It was so small that it hardly spanned the fingers of his hand. He was told that English fans were going crazy over these half-size, HO-gauge jobs because a whole layout could be put on a bridge table. The only trouble was that nobody had been able to design a motor small enough to fit in such a model and at the same time strong enough to haul a heavy train.

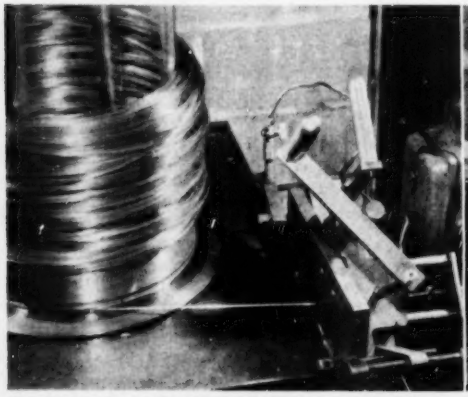
Tyler saw his opportunity. He came up with a rugged little power plant, not much larger than a sewing thimble. Before he knew what was happening, he was out of his back-yard workshop and deep in the full-scale business of manufacturing small-scale railroads. He is generally credited with being the first to produce American HO-gauge equipment on a commercial scale. His firm, Mantua Metal Products Co., is now one of the largest in the field, and turns out a complete line of locomotives and cars in easy-to-assemble kit form.

In his modern factory, staffed by 50 employees, Tyler does all his own fabricating. He buys only screws and basic raw materials, performing all forming, machining, casting, molding and finishing operations himself to insure precise control of the finished product.

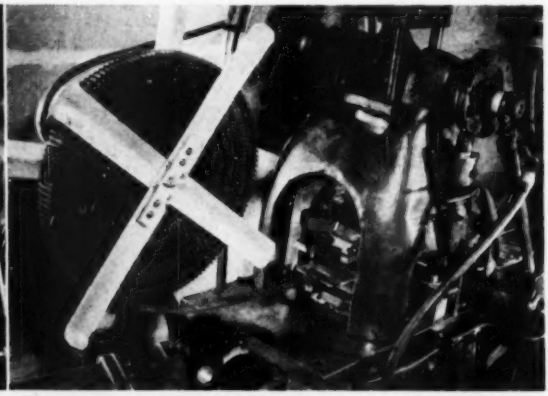
On the other side of the country, Rollin Lobaugh had nearly forgotten the cigar-box car models he built as a boy when his wife gave him 100 feet of steel rail and a built-up O-gauge switch for Christmas, 1930. Lobaugh was already in the manufacturing business, and the cost of custom-built engines for that gauge set him to thinking. Quantity-production methods could bring this hobby into a lot more homes.

Builds Mostly Locomotives

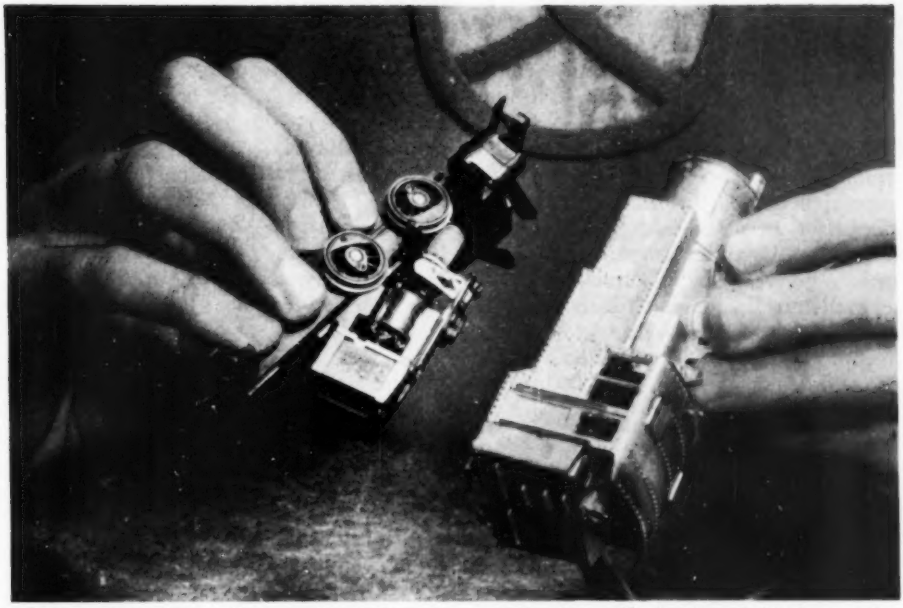
Lobaugh concentrated on locomotives, pioneering such features as individually sprung bearings, the enclosed gearbox, lost-wax castings, and the type of two-rail pickup which uses the engine for one contact and the tender for the other. Two months ago he moved his prospering business into a brand-new plant, where he and his 45 employees will soon commemorate the event by launching a new model—a Chesapeake & Ohio 4-8-4.



TO MAKE A MILLION FEET of track a year, Atlas Tool Co. shapes round brass wire into T-shaped rail by passing it through rollers.

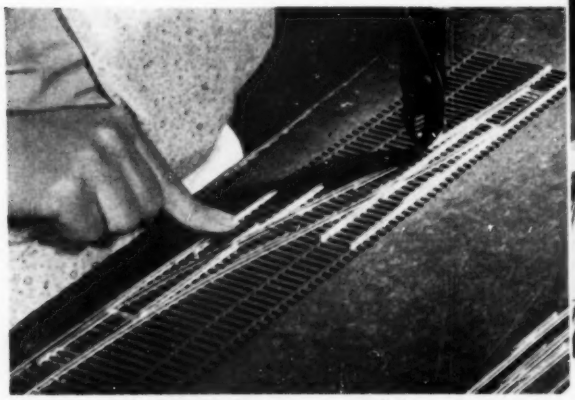


ROLL OF VULCANIZED RUBBER provides the ties. In this high-speed press, rubber is stamped to form a continuous strip of ties.



BOOSTER SWITCHER packs a modernized version of the motor which put Tyler in model-train business. Production of this locomotive model alone exceeded 20,000 units in 1952.

Out in Milwaukee, a stocky youngster, aged six, never dreamed that the train he received for Christmas, 1900, would someday turn his own life into a madhouse of activity. But during the great depression, the office firm with which William K. Walthers was connected went bankrupt. That gave Walthers



TWO SWITCHES are connected for a crossover. Tiny spikes are pressed into properly spaced and prepunched holes.

ROADMASTER STEPHAN SHAFFAN with some of switches which the Atlas Tool Co. sells at the rate of 250,000 a year.

time to write a book. He had constructed a $3,000 standard-gauge railroad by then, so the subject was obvious.

Other model-railroad fans read it, and they wanted to build the items Walthers described. To oblige them, he scrounged around for suitable parts, and the fans were glad to buy this stuff. At first, he specialized in signal and control equipment. But he quickly found a market for locomotives, cars and track. In 1932 he went into business, officially, as William K. Walthers, Inc. He had virtually no capital but a lot of know-how. Today his catalogue lists more than 3,000 items.

Gauges Get Smaller

A similar willingness to help other model railroaders was instrumental in getting Sherman E. Dance of West Englewood, N. J., into a profitable business. A printer-artist-teacher by profession, Dance applied his talents to the painting and lettering of his own model trains. Friends who saw and admired his work asked him to noodle up their own cars. He did. He then designed a series of freight cars in a new, and even smaller gauge than HO.

Dance delivered his first TT kits in 1951, and they were a hit from the start. Working alone in the basement of his house, he has built up a fine little business, with 25 dealers scattered all over the United States. He now produces 66 different items under the trade name Gandy Dancer.

Mechanical rather than artistic ability led C. J. Ulrich of North Hollywood, Calif., into the manufacturing line. Eleven years ago, when he was designing bomb bays for North American Aviation, a fellow engineer brought in a 35-cent paper model of a freight car. Ulrich assembled it, rolled it across his desk—and he was hooked.

But model railroaders are critical, and an engineer like Ulrich soon found fault with the best commercial equipment.

"Why hasn't someone designed a simplified gondola car that works like the real ones?" he asked himself. "Or a three-color signal, or a track cleaner?"

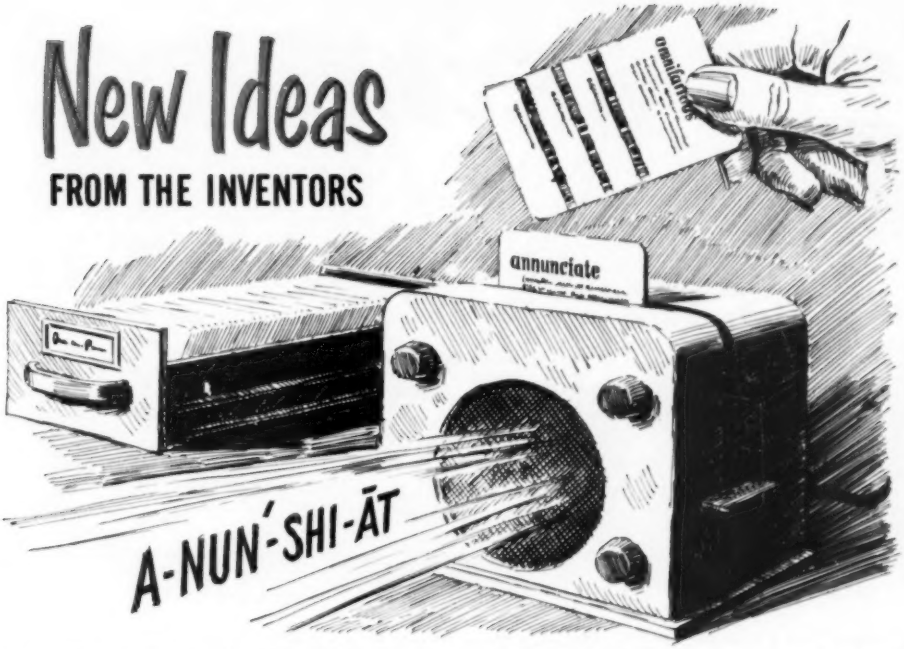
In 1946 he started turning out three-color signals in his garage workshop. The item caught the fancy of other model

[*Continued on page 246*]

THREE MEN AND A HOBBYHORSE. Charles Menteer, Weldon Purcell and Charles Voelckel specialize in model-railroad castings. In photo above, Voelckel tries out a new machine which assembles wheels and axles. Boilers at right are ready for trimming.

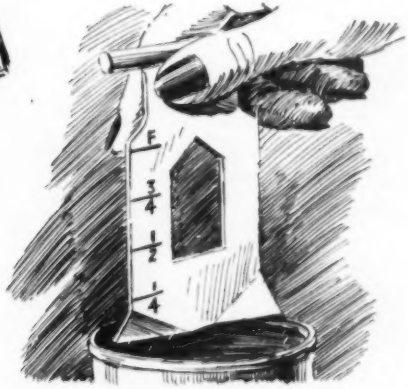
New Ideas

FROM THE INVENTORS



1 Dictionary to Talk Out Loud. To tell how to pronounce words, this talking dictionary would speak them. Its vocabulary consists of cards bearing magnetic sound tracks, like those of tape recorders, besides printed text. When a user selected the card for the desired word and placed it in an electrical unit, the card would move past a sound pickup head, and a loudspeaker would pronounce the word correctly.

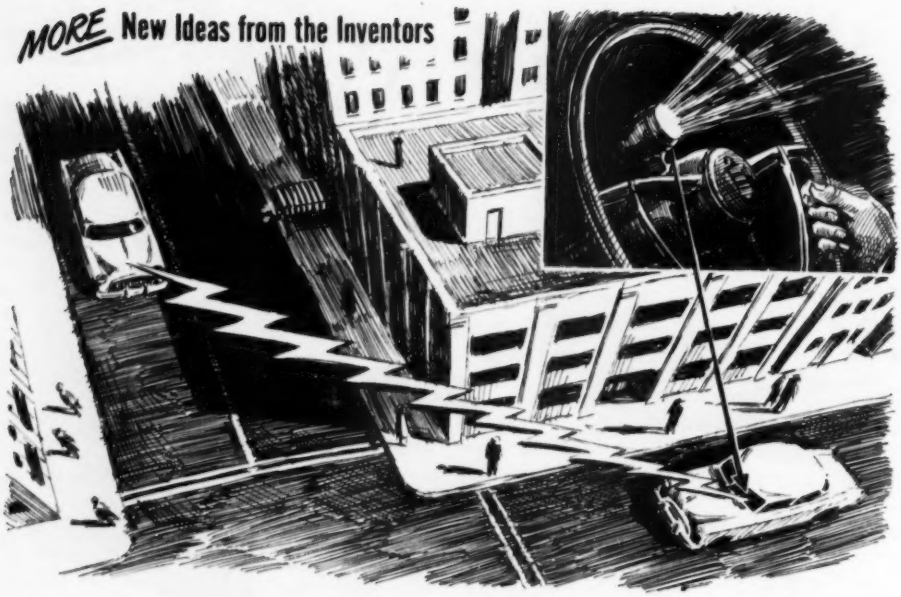
2 Trigger to Be in Gun Handle. You could use pistol or rifle equipped with this arctic-style auxiliary trigger without removing gloves or even mittens. With the safety catch released, squeezing the handgrip would actuate a pivoted plate forming an extension of the regular trigger, and would fire the weapon.



3 Scoop to Get What's in Can. This "disher-outer" would make it easier to remove dog food and other sticky semisolid foods from cans. When inserted in a can and twisted, its oppositely inclined lips would lift out the contents. The graduations marked on the scoop would aid in serving exactly the amount of food needed.

Please turn the page for more new ideas.

MORE New Ideas from the Inventors



4 Signal to Prevent Collisions. This device would spot an oncoming car that couldn't be seen around a corner or over a hill. High-frequency waves from the other car's ignition system, picked up by an antenna, would flash a warning light (inset). With its directional antenna slanted to right, the device would detect cars nearing blind corners in city streets. It would work whether or not the other car has it, too.

5 Hollow Slices to Make Sandwiches. A loaf of bread of this style could be made into sandwiches in a jiffy. Each of its pre-sliced sections would be as thick as a complete sandwich, and would have its center hollowed out and open on two sides, so you could insert filling as above.

6 Extra Valve to Send Hepcats. If brass wind instruments had this special valve, beginners could give out with "gliss" tones, or slur notes, to the delight of jazz connoisseurs. To obtain this effect with a standard instrument a musician must be skilled in "half-valving" or "lipping."

Patents on these inventions have been granted to: 1. Chester M. MacChesney and Ella B. Wenger, Chicago; 2. Clarence E. Simpson, Springfield, Mass.; 3. George P. Wakefield, Vermilion, Ohio; 4. Carl H. Holm, Honolulu; 5. Ambrose Ryder, Yonkers, N. Y.; 6. Anton Solarz, Minneapolis.

WILBUR SHAW REPORTS FROM THE DRIVER'S SEAT:

Buick Hooks New V-8 to Dynaflow+Gears

The result is a red-hot drive that gives you gear-fast getaway plus smooth torque-converter cruising in a single transmission.

I WOULD never have believed it if I hadn't seen it.

I was doing 60 miles an hour from a standing start in 14 seconds in a Buick Roadmaster—with a torque-converter transmission. Last year's Buick took 19 seconds to reach 60. But now I was behind the wheel of a 1953 job.

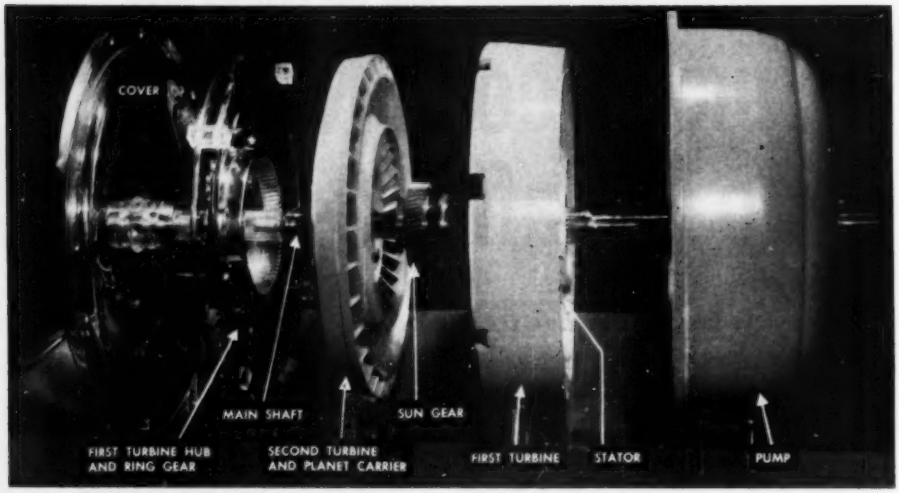
I reached 80 miles an hour in 21.6 seconds, compared with 28.4 seconds for last year.

On the lower end of the acceleration range I was at 30 miles an hour in 5.6 seconds compared with 7.4 in 1952.

The speedometer was calibrated and all speeds were true. But behind that acceleration is a whole catalogue of improvements, including a spanking-new V-8 engine and an automatic transmission the like of which has never been seen before.

The Buick used to lag when the light

Looks the same, but, boy, what a difference in performance. Hood is now front-opening alligator type in place of side-hinged one. Fenders and hood are higher. The Roadmaster's weight is reduced—engine is lighter, wheelbase shorter.



Extra turbine and planetary gears provide fast getaway in new Dynaflow. In starting, pump directs oil at turbines. As oil rebounds from blades, it strikes stator, which can turn only one way, and holds it stationary. This locks sun gear, fixed to stator. First turbine, bearing ring gear, thus cannot turn sun and must drive torque-multiplying planetary gears connected to output shaft. As car reaches cruising speed, oil rebound lessens, allowing sun and stator to turn. First turbine and sun then free-wheel, and cruising power comes from second turbine, locked to output shaft and driven by oil acting as simple fluid coupling. Another gear set (not shown) provides emergency low and reverse.

turned green. With the accelerator on the floorboard, the engine wound up and a high fuel consumption was the inevitable consequence. That kind of a performance was a disservice to one of the grand old names in American automotive history.

Buick introduced what it called Dynaflow, a torque-converter type of transmission, to the U. S. passenger-car field in 1948. For four years Buick clung to the torque converter without gears in the Drive Range to boost the engine's push at the rear wheels from a standing start. Meantime, several other companies out-distanced it.

But now a spectacular improvement has been made. The new transmission reacts to the accelerator foot exactly like the old one—you get no thump of gear-changing. The whole operation is as smooth as silk. But the performance is different.

To understand what Buick has done

FACTS ON '53 BUICK

Model: Roadmaster 4-door sedan.

Engine: valve-in-head V-8; 188 hp. at 4,000 r.p.m.; compression ratio, 8.5:1; piston displacement, 322 cu. in.; piston travel (in feet per car mile at 20 m.p.h.) 1,396; bore and stroke, 4.0" by 3.2"; crankshaft bearing surface, 16.83 sq. in.; torque, 300 lb.-ft. at 2,400 r.p.m.

Weight: 4,089 lb.; per hp., 21.75 lb.

Transmission: Twin Turbine Torque Converter, rear-axle ratio, 3.6:1.

Steering ratio: 21.3:1, radius of turning circle, 20.7'.

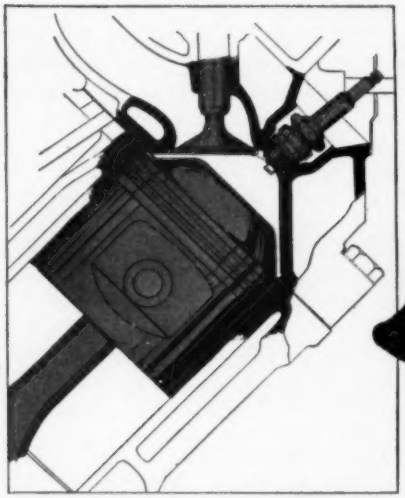
Effective brake-lining area: 219 sq. in.

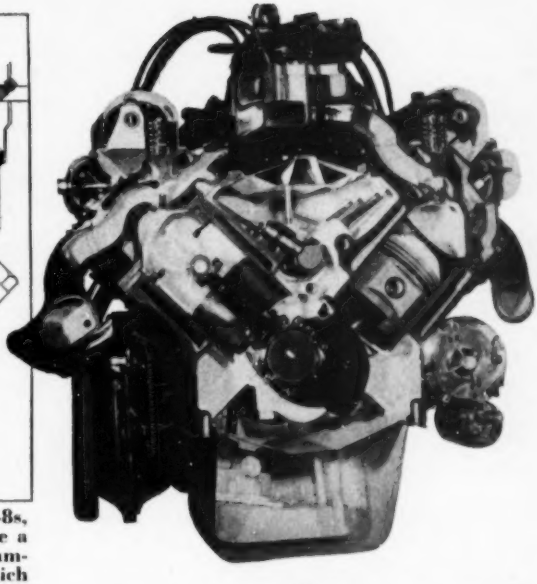
Springs: coil front and rear.

Outside dimensions: height, 63"; over-all length with bumpers and guards, 211.6"; width, 79.9"; wheelbase, 125.5"; overhang, front 34.6", rear 51.5"; tread, front 60", rear 62.2".

Inside dimensions: seat-cushion width, front 64.1", rear 64.3"; leg room, front 44.7", rear 43.4"; headroom, front 35.6", rear 34.8"; seat height, front 13.9", rear 12.9"; vertical distance, steering wheel to seat cushion with seat in mid-position, 4.2"; front-seat adjustment, horizontal 4", vertical .25".

Tire size: 8.00 by 15.





Vertical valve action, a novelty in V-8s, is shown in the drawing above. Take a look at the compact combustion chamber and the centered spark plug, which shorten flame travel. At right is a cutaway of the engine. The power and compression ratio have been boosted with practically the same displacement.

requires a look at converter developments in the last five years. Not long after Buick brought out a torque converter, other manufacturers not only saw them but raised the ante. Competitors recognized that the converter alone didn't do so well at take-off.

You Could Feel Gears Change

So they added mechanical gears to give their torque converters a helping hand. These gears were of the planetary type, borrowed from Henry Ford's old Model T. They were housed in a separate transmission unit *behind* the torque converter. And they worked.

But they had one fault. When the assisting gears rolled out of the power train as the car gained speed, passengers could feel it. The car pitched forward slightly. The amount was in direct ratio to the accelerator pressure exerted by the driver.

Buick mulled that over. There had to be some way to boost acceleration without paying the penalty of a thump. The company's engineers began working on

I wanted to see what the added oomph would do on a hill. Here's the result on a 11.6-percent grade. The top picture shows the two cars starting out abreast. See how the '53 is leading the '52 at the 400-foot marker.

the problem more than three years ago. Today they've got the answer—a new kind of pump-turbine combination and a planetary-gear set *inside* the torque converter itself.

There's nothing else like it in the automotive industry. The gears do their work as you press on the accelerator from a dead stop. But as you gain speed they quietly bow out of the operation. There is no gear-changing as such. The assisting gears just gradually hand over their task to the main transmission medium, the pump and turbines.

I am stressing this Twin Turbine Dynaflow at the expense of that brand-new V-8 engine. There's a reason.

The company's engineering charts show that less than a third of the car's increased performance on the lower end of the acceleration scale can be attributed to the engine. The rest comes from that transmission.

Zero to 80 in 20 Seconds

I drove a Roadmaster, biggest-powered car in the Buick stable, at the General Motors Proving Ground. For fun, I logged the acceleration time starting in Low Range (emergency low) on the selector quadrant, shifting to Drive Range for the sprints when the speedometer indicated 50. Here are the results:

Zero to 30 miles an hour—4.4 seconds compared with 5.2 seconds for the old Roadmaster.

Zero to 60—11.4 seconds compared with last year's 14.7.

Zero to 80—18.9 seconds compared with 23.8.

Then I tried out the high-speed acceleration. That's the amount of sass you get from an engine when you pull out to pass on the open highway. It took just 7.4 seconds for the speedometer needle to climb from 60 to 80 miles an hour. That compared with 10.8 seconds for last year's car.

And—to do justice to the new engine—that's where the power comes in. Buick's rugged old straight eight produced 170 horsepower last year. The new engine delivers 188—just two horsepower less than the '52 Cadillac. Buick's V-8 is the first ever put into production by the company in all its 50-year history.

The V-8 isn't confined to the Roadmaster series. The Super series has it, too, with a horsepower rating of 170. Only the Special, third in line among Buicks, retains the straight eight.

You Use Less Gas

The new V-8s are economical. Most of the stinginess on gas comes from a higher, and exceptional, compression ratio—8.5 to 1 compared with 7.6 last year. Compress the gas-air charge more in the cylinders, and it burns better. I registered more than 17½ miles per gallon at a steady 50 miles an hour on premium-type fuel in the Roadmaster. That compared with less than 16 miles per gallon for the lower-powered '52 job.

The new engines have a couple of special gimmicks to boost their efficiency and save wear. The cylinders of a V-8 in today's designs incline from the vertical at an angle of 45 degrees. Overhead valves tend toward the same slant.

But not Buick's. This company's valves incline 45 degrees from the axis of the cylinders so that they operate straight up and down. That's done so that the rocker-arm covers can be mounted on a

[*Continued on page 248*]

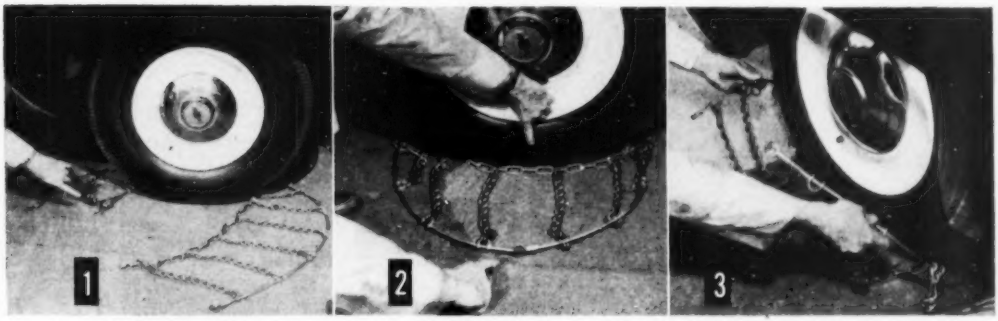
More and more people are using the left foot on the brake. This pedal position is a help.

Buick's first production V-8 carries this emblem—also the lid handle—on the rear deck.

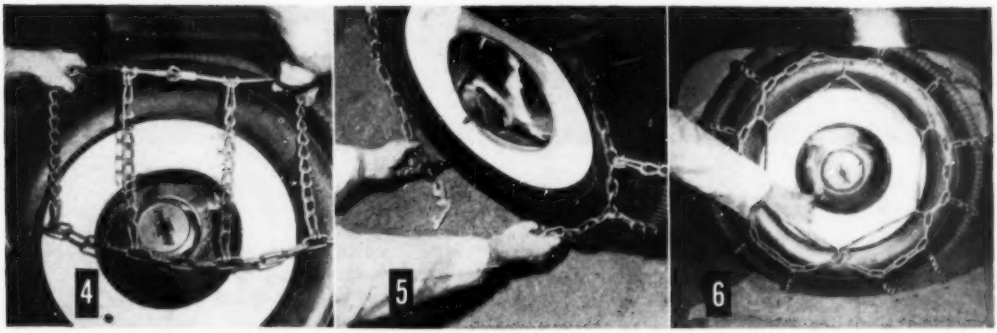
Putting On These Chains Is Painless

YOU now can put on tire chains without moving the car or jacking up the wheels. Chains of a new type wrap around the tires. Putting them on at first seems more complicated than tying a sheepshank knot. But when you get the hang of it, the job goes fast. The chains, in fact, go under the name of Minit-on. A single chain has been put on in 20 seconds. Cleveland Chain & Mfg. Co., Cleveland 5, makes them.

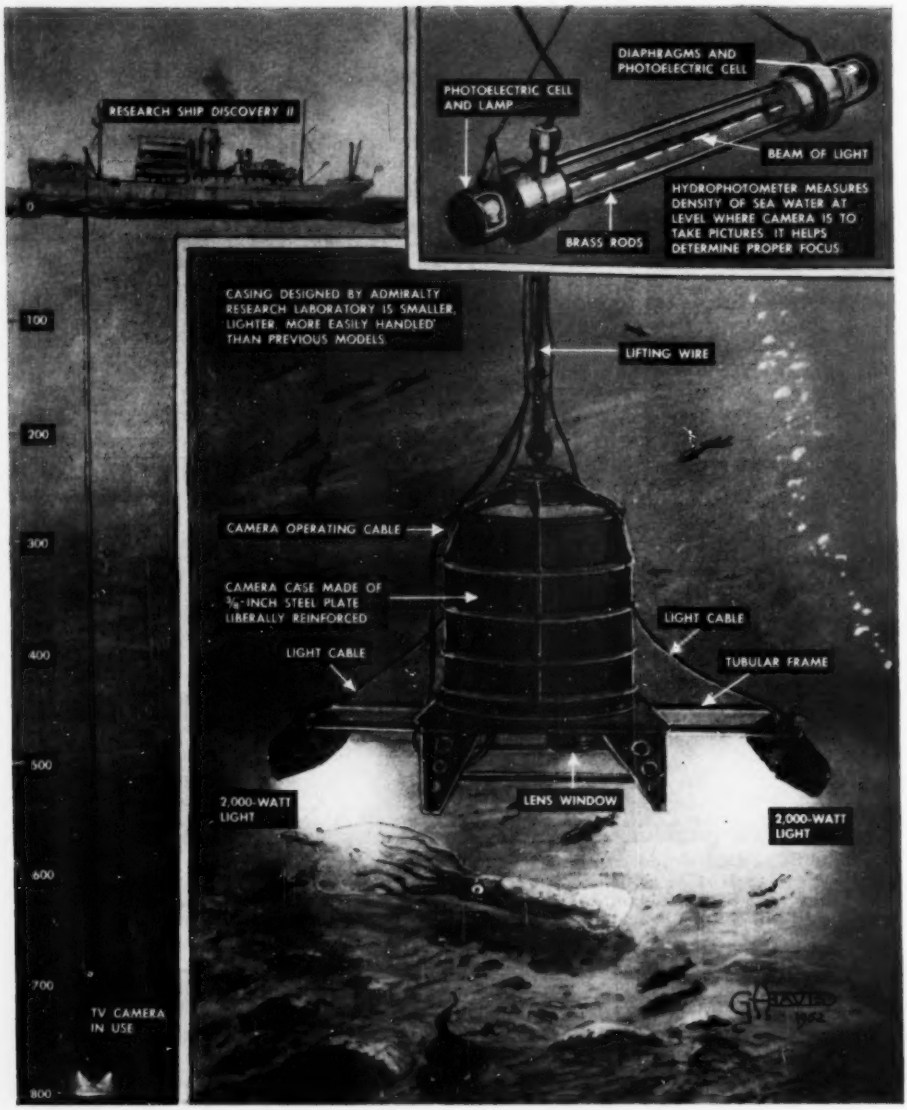
A CABLE and special fasteners are substituted for conventional links along one edge. These hold secret of speedy mounting. Package includes sleeves to pull on over coat.



YOU WHIP THE CHAIN around tire like this (left above) in early stage of mounting. End of cable indicated by finger is then joined to fastener at right and entire chain dragged around to the left and until second fastener is directly in front of tire (center photo). This fastener is then loosened and chain jerked up around sides of tire (right above).



FASTENER AT TOP can finally be connected and the chain pushed over the top of tire (left above). Pull-on sleeves are especially handy at this point. Chain then droops down around the tire in running position except for fastening the conventional snap (center photo). Applying tightener completes the job (right above). Chain can be removed easily, too.



New TV Camera Explores Ocean Floor

ACROSS the Bay of Biscay and down the coast of Portugal to the Azores, scientists aboard a British research ship have been studying shoals of fish and the ocean bottom on television.

A new submarine TV camera, which can be used 1,000 feet or more below the surface, practically fills a three- by two-foot steel casing. Specially reinforced to withstand powerful water pressures, the casing weighs 896 pounds, but that is less than half as much as previous models.

Two 2,000-watt bulbs light the TV camera's subjects. The cameramen use a new instrument called a hydrophotometer to help determine the correct focus.

Jet-Powered Dishwasher runs on water pressure from the kitchen sink. Dishes are completely immersed in water, revolve in rack for washing, rinsing. Bessen Co., Box 3561, Chicago 54, makes it.

New Machines Cut Homework

Ice Maker that hooks into the water system eliminates the chore of filling ice trays in the new Servel refrigerators. Half circles of ice are frozen without trays, stored, replenished automatically.

Two-Level Sink has a waste well with its own drain and plug in an upper shelf at one side. It is lined with a perforated basket, can also be used to chill food. American-Standard calls it the Duwell.

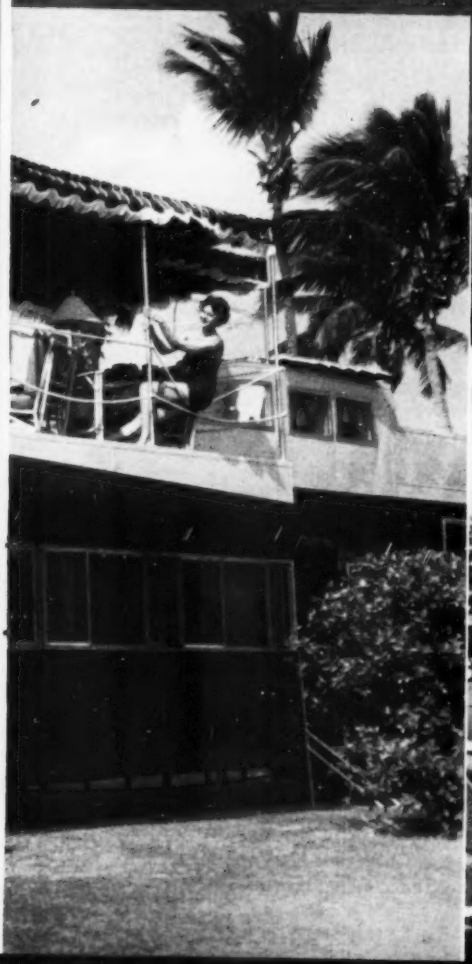
Double-Duty Machine that washes and dries clothes in one continuous operation can turn out load ready for ironing in 68 minutes. Arrows show how air is routed during drying in Bendix Duomatic.

World's Biggest Trailer Crosses Continent

This luxurious leviathan allows a millionaire gypsy to take his swimming pool and helicopter landing deck right along with him.

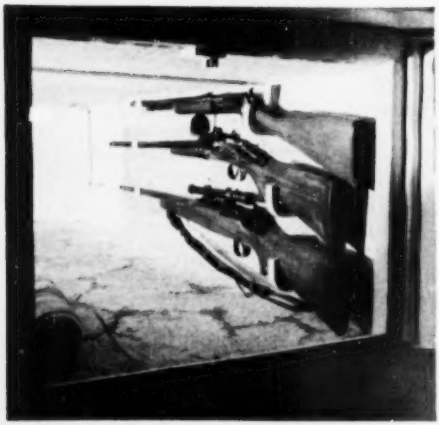
By Hartley E. Howe

SO YOU take that $75,000 that keeps getting mixed up with the socks in your top bureau drawer and you buy yourself an Executive Flagship. The day she's delivered you take off, you and the missis relaxing in overstuffed lounge chairs while your cook broils a steak and your skipper, up forward in the driver's



EXECUTIVE FLAGSHIP, a huge rust-and-ivory land yacht, is luxuriously equipped for the footloose tycoon. Above, the Flagship is ready for the road, her portable 10,000-gallon swimming pool (left) and folding sun deck (below) stowed for travel. Diving board, deck furniture, railing and awnings all go into cabinets in the trailer. Swimming pool, 23 feet across, is dismantled and packed into storage space above the cab.

PORTABLE SWIMMING POOL is set up in about an hour by bolting together six curved aluminum wall sections. Yard of sand in bottom steadies sides, then a baglike plastic liner is inserted. Filled, tank holds 5½ feet of water.



"ELEPHANT GUNS," says Mid-States Corp., builder of the Flagship, "are in case the owner wants to go on a safari to Africa. They're located in the dining nook." No elephants were encountered on California-Florida run.

seat, pushes along at a steady 50 m.p.h.

Late that afternoon the skipper backs into a mountain meadow. He and the road officer—second in command—break out the swimming pool, and an hour later you're doing jackknives from the sun deck . . .

Okay, okay, this is strictly dream stuff. But the Executive Flagship, biggest house trailer ever to hit the road, is no dream. If you have $75,000, you can go buy it tomorrow and drive away.

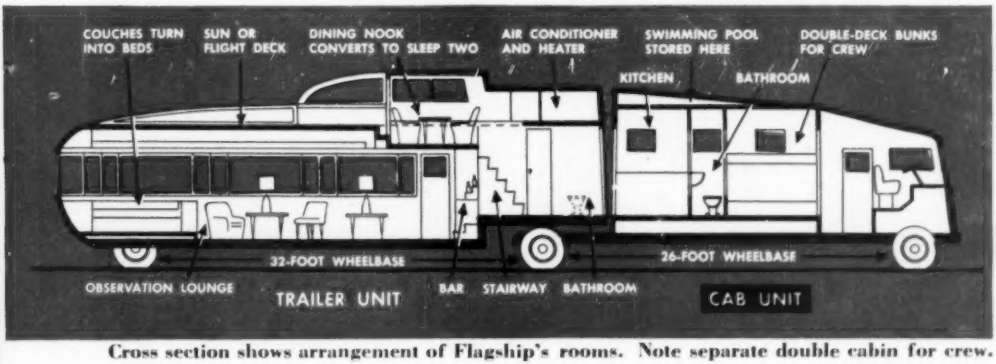
For the Flagship is the very real creation of the Mid-States Corp., which claims to be the world's largest maker of mobile homes—house trailers to you. It weighs 18 tons, rolls on 10 wheels, sleeps six, and not only has a portable swimming pool with diving board but is complete with kitchen, two bathrooms, a seven-foot bird's-eye maple bar, two refrigerators, wall-to-wall carpeting, radiophonograph, 21-inch TV, movie screen, indirect lighting, wine cellar, air conditioning, intercom, radiotelephone, "pooch porch" for the dog, and three elephant guns in case you have to shoot your way through a herd of pachyderms on the Lincoln Highway.

And if this isn't enough for you, the upper sun deck can be used to board your private helicopter.

All this is packed into a 65-foot articulated tractor-trailer. The Flagship is 13½ feet high and nine feet wide, but the sun deck unfolds to 16-foot width. The power plant is a 128-horsepower International truck motor with 10 for-

Side view points up 65-foot over-all length of Flagship. Two sections are permanently joined.

Frame of super trailer is 2- by 2½-inch angle steel. Aluminum side walls are riveted on.



Cross section shows arrangement of Flagship's rooms. Note separate double cabin for crew.

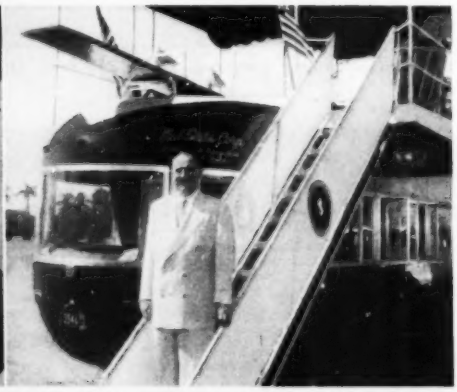
TOP DECK is reinforced, can be used to land light helicopter (picking up blood plasma, above). Folding wings, opened with a winch, give sun deck a total of 250 square feet.

ward speeds—five standard speeds plus a two-speed rear end.

Designed by Peter Kohler, the Executive Flagship is the dream child of William B. MacDonald Jr., who started out 20 years ago as a bus driver and now is president of Mid-States. His company turns out 7,500 house trailers a year. So far only one Flagship has been built, but MacDonald reports nibbles and expects more on the road soon.

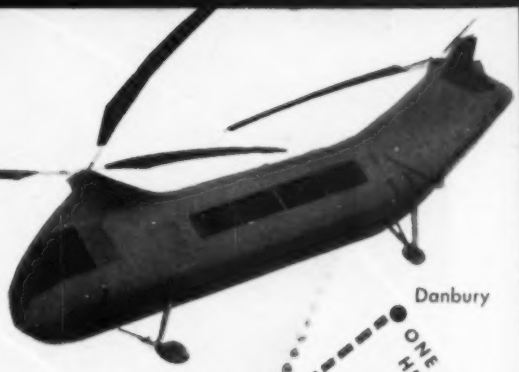
Anybody who sets out to tour the world in luxury in his own Flagship has one chore to attend to before starting. The Flagship is so big that on its recent shakedown cruise from Los Angeles to Miami it required a special permit from every state except Arizona. END

INTERIOR, facing aft, looks like Pullman observation car. Twin couches in stern turn into beds. Two people can sleep in dining nook overhead, reached by stairs.

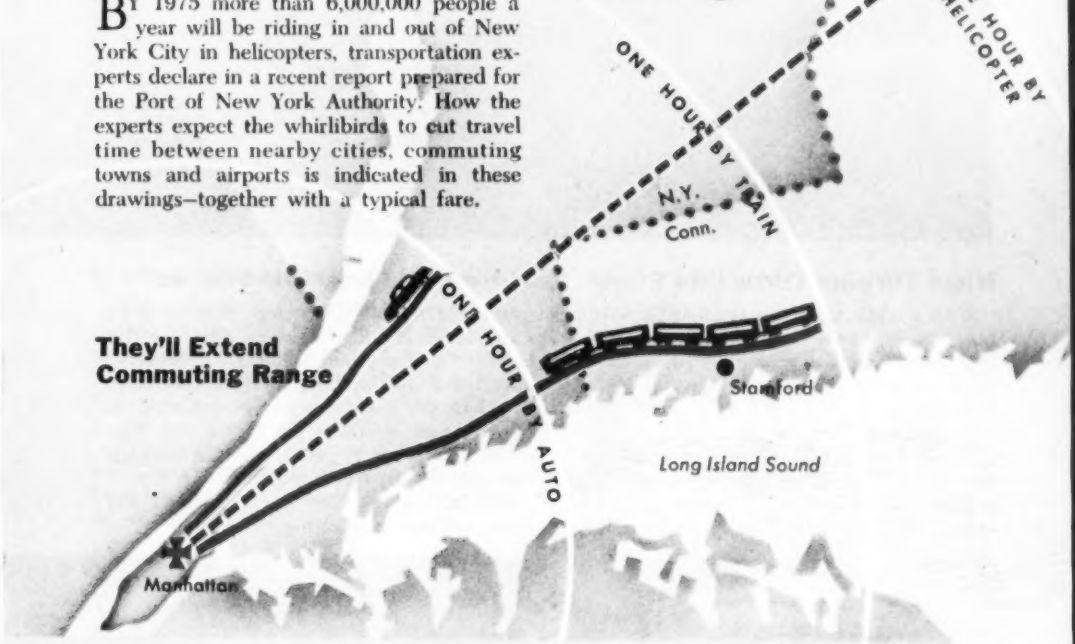


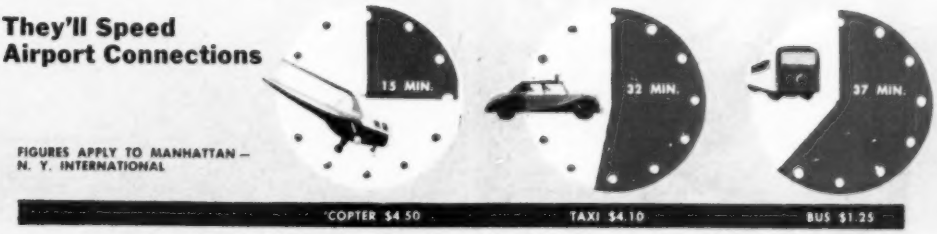
WILLIAM B. MacDONALD JR., President of Mid-States, stands on Flagship gangway, which stows away for road travel. He got into trailer building through hauling units for others.

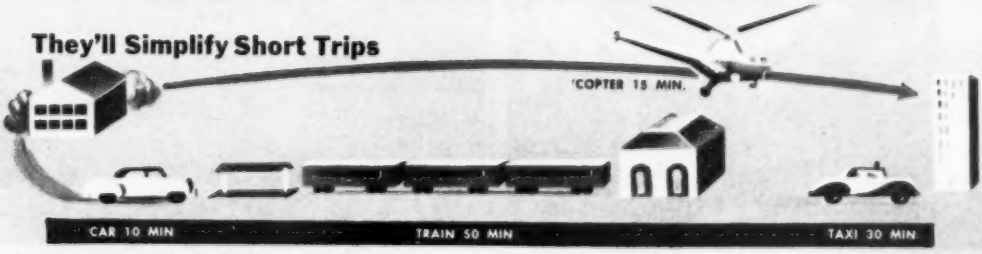
'Copter Cabs Are Coming



BY 1975 more than 6,000,000 people a year will be riding in and out of New York City in helicopters, transportation experts declare in a recent report prepared for the Port of New York Authority. How the experts expect the whirlibirds to cut travel time between nearby cities, commuting towns and airports is indicated in these drawings—together with a typical fare.







Uncle Sam's Big Shooting Gallery

Shots fired by Navy scientists through the 18-inch hole in the near end of the 500-foot shed above, at Inyokern, Calif., are expected to help improve the design of rockets. They are telling shots because they are photographed in flight.

Twenty-three pairs of electronically controlled cameras (right), tilted upward 45 degrees, take millionth-of-a-second flashlight pictures of the missiles as they zing past. Each camera takes six exposures on a single plate.

Huge Turbine Turns Into Pump

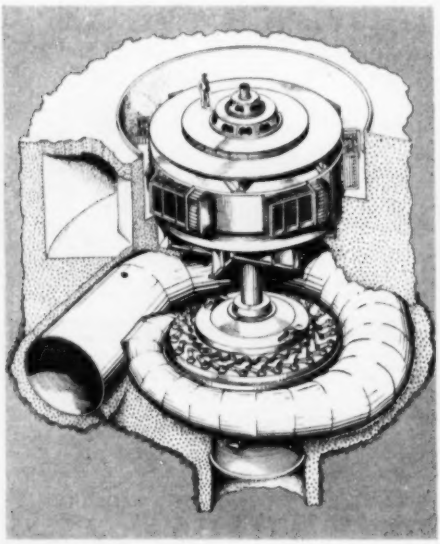
The world's largest reversible pump-turbine, shown in the drawing below as it will look installed, is expected to be ready for work at TVA's Hiwassee Dam in North Carolina late in 1955.

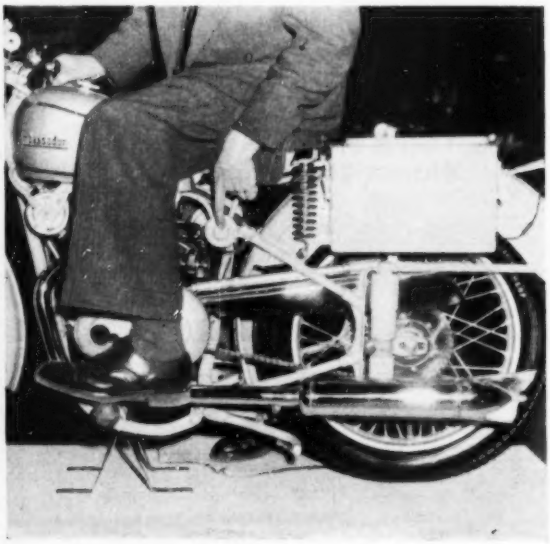
As a water-driven turbine, it will generate 120,000 horsepower. When reversed and driven by a 102,000-horsepower motor, it will be able to pump 3.3 billion gallons of water a day. Allis-Chalmers is building it.

Motorcycle Has Self-Starter

British motorcyclists may soon have no more kicks coming—to start, that is. The machine in the photo below has a battery-operated starter motor under the fuel tank. The battery, a six-volt model mounted in two sections, straddles the rear wheel. The rider merely has to press a button beneath the seat to start the motorcycle.

The battery is said to be capable of 1,000 starts without recharging.

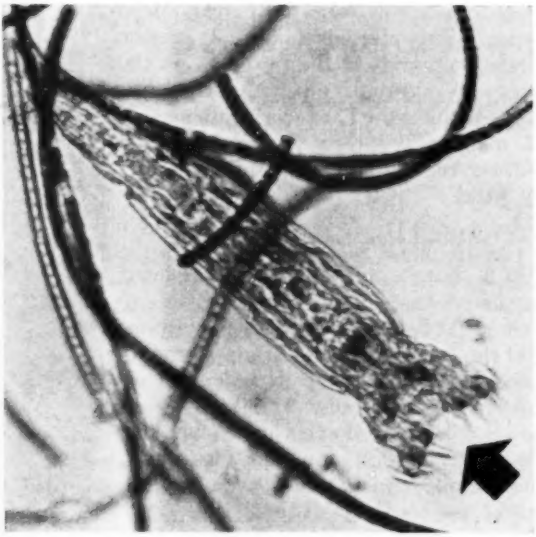




Fastest Movement "Stopped"

THE fastest-moving parts of any living animal are the tiny hairs on the head of a microscopic organism called a rotifer (below). They vibrate so fast that they look like whirling wheels. In previous photographs they have been mere blurs.

Now Capt. E. L. Gayhart of Johns Hopkins University, with a millionth-of-a-second flash, has made the "wheels" (arrow) appear to be standing still.



75 years ago this month

Popular Science Monthly reported:

"OVERWORK connected with business is always sure to be a more tangible factor of mental disease than overwork from study, because of the much greater liability to its invasion during the business period of brain-life than the study period. At Bedlam Hospital Dr. Savage finds that there are many cases in which overwork causes a breakdown, 'especially if associated with worry and money troubles.' Among the women, the cases are few in number."

Auto Factory Almost Runs Itself

Crankshafts, blocks and body panels march through machines untouched by human hand. Someday whole cars may pop out.

By Carl Konzelman

AT ITS Buffalo body-stamping plant, the Ford Motor Co. has taken the wraps off a dramatic new kind of production line that turns out auto parts better and faster—with a minimum of human failure and human drudgery.

At Detroit, the Chrysler Corp. is rushing to completion its second crankshaft forging line created on a similar theory. Its first, disclosed last September, is so successful that many other industries are examining its methods of forging complex parts with the idea of following suit.

Cleveland has its own contribution in the same field—a Ford engine plant that ranks among the first to use the new principle to out-mass-produce the mass-producingest industry of them all.

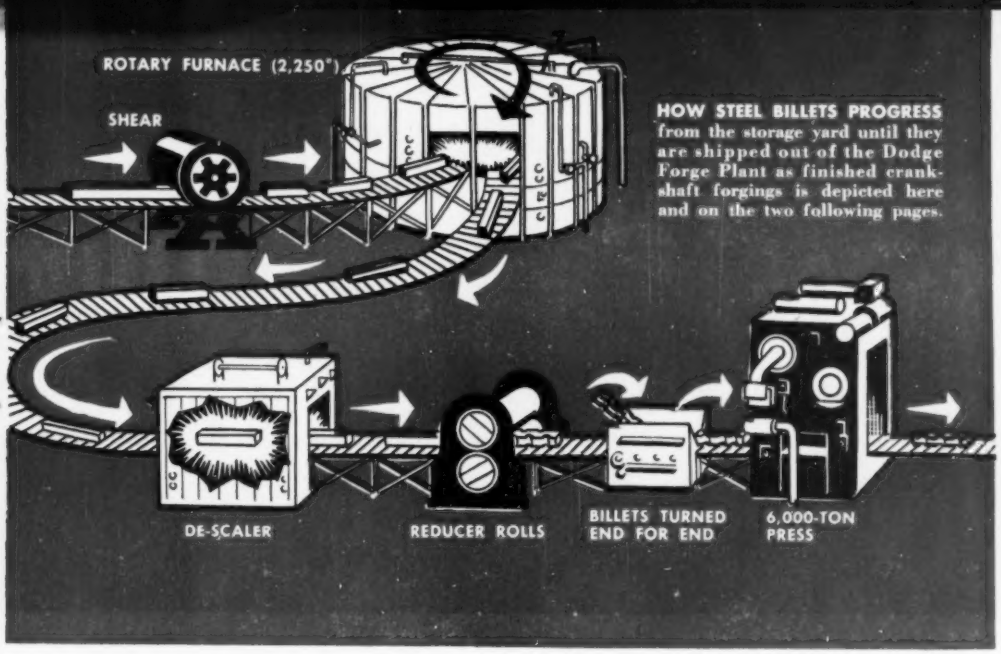
All three plants are examples of the auto makers' newest, brightest gimmick—automation.

Automation is more than a matter of individual machines. Actually, it is the tying together of existing machines with electric controls, shuttles, trips, "iron hands." The piece is taken out of one machine, moved to the next one on the line and inserted, all without human help—without the hard work and hazards of manhandling heavy parts and the tedious repetition of feeding machines by hand.

Skilled Manpower Still Needed

Will automatic factories mean vast numbers of unemployed? The answer to that might be found in another question: Did the original coming of mass production put men out of work? Look at industrial payrolls today. The fact is, manpower is short, and every man saved one place will be used someplace else. Skills, and people capable of learning skills, are in greater demand than ever.

At the new Crankshaft Press Shop of



HOW STEEL BILLETS PROGRESS from the storage yard until they are shipped out of the Dodge Forge Plant as finished crankshaft forgings is depicted here and on the two following pages.

the Dodge Forge Plant in Detroit, crankshafts are turned out at two to three times the previous rate. Better crankshafts, too, for human error is minimized.

Heart of the new process is the giant 6,000-ton forging press, which replaces the steam hammer—the troublesome unit normally used for forging "cranks."

Second major element is a rotary furnace which automatically receives, heats and discharges up to 300 an hour of the metal bars, or billets, from which the crankshafts are forged. Heat-treating and tempering furnaces form the third big unit in this modern miracle system.

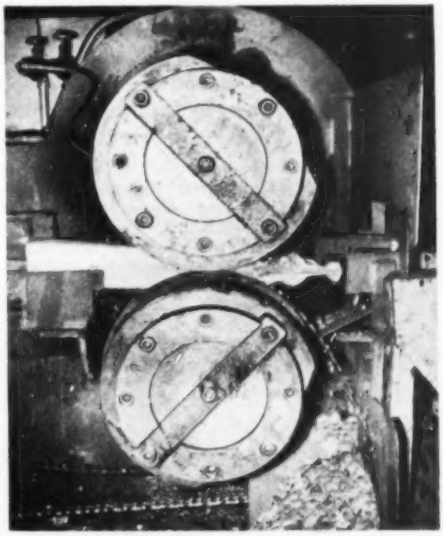
Presses Are Quiet

Going into the new shop from an adjoining building where hammers are pounding is like walking suddenly into quiet sunshine from a thunderstorm.

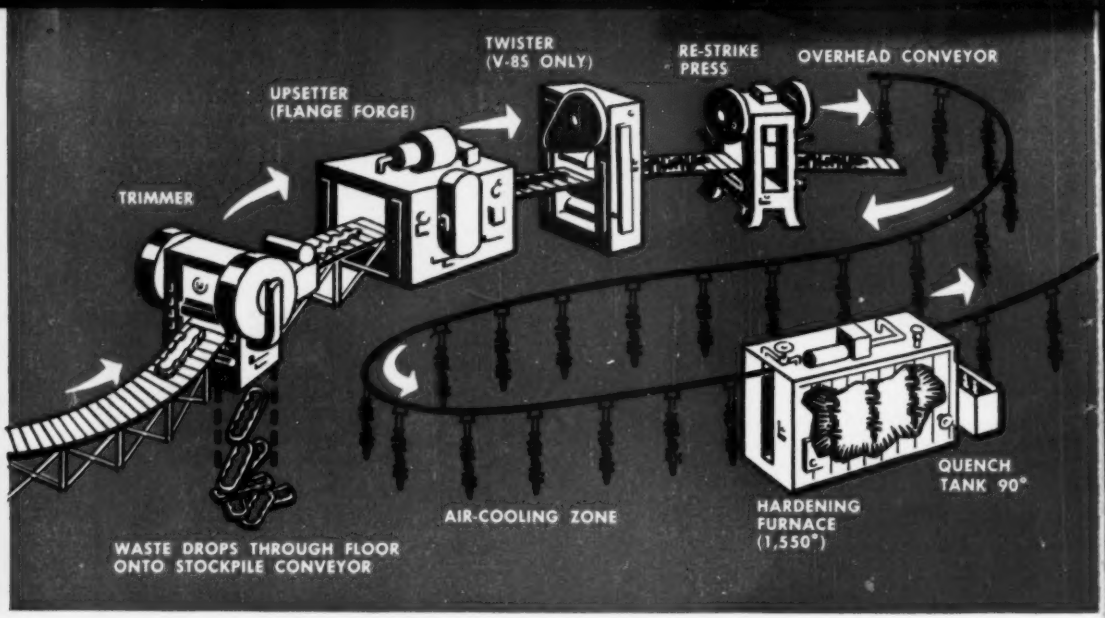
At one end of the 462- by 150-foot plant, where the business of making a crankshaft begins, 20-foot billets move smoothly by magnetic crane from the yard to a rack in the plant wall. A hydraulic cylinder nudges them one by one into a furnace for pre-warming at 400°.

Dumped from the warmer, the billets ride a conveyor into a shear. As each billet touches a trip, a 1,300-ton pressure knifes through the four-inch-square metal like a razor through filet mignon.

Automatically, as the billets reach a rotary furnace, a hydraulic jaw clamps



AT THE DODGE FORGE PLANT, a heated crankshaft billet passes through the reducer rolls that distribute the metal where it is needed for the press-forging operation that follows.



each piece, moves it through the open hearth and places it gently on the fire-brick floor. The jaw moves out for another bite and the 32-foot circular floor rotates to let another billet in.

You could get a man-size burn just standing too close to the two openings in the side of this huge, doughnut-like contraption—2,250° to 2,300° is the temperature inside. But it takes an hour for the billets to make the circuit and show up ripe at the second opening.

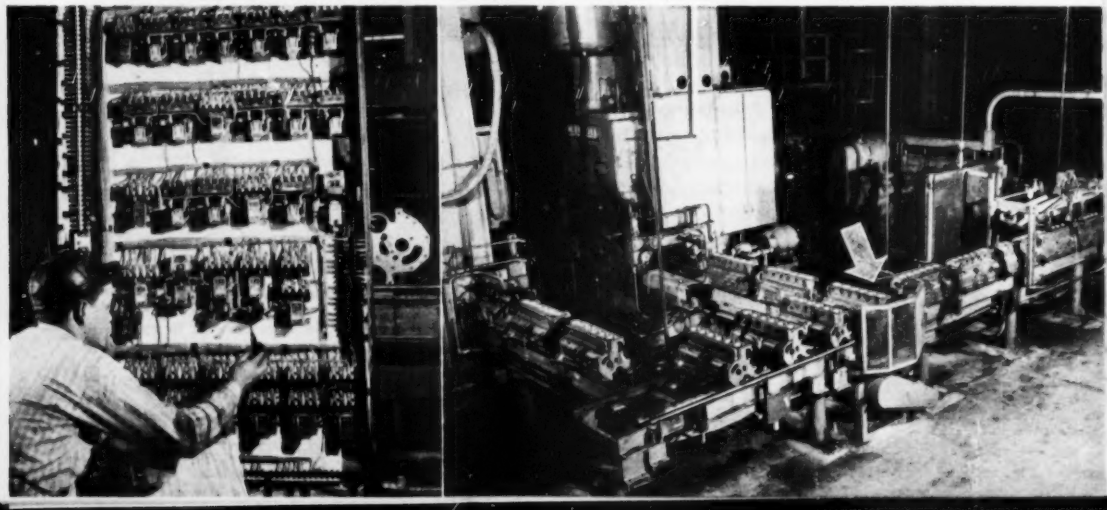
There another hydraulic jaw plucks them out and deposits them on a gravity slide. A turntable rotates them 90° and they're off through a de-scaler where four jets clean the billet with 1,500 to 2,000 pounds per square inch of water pressure.

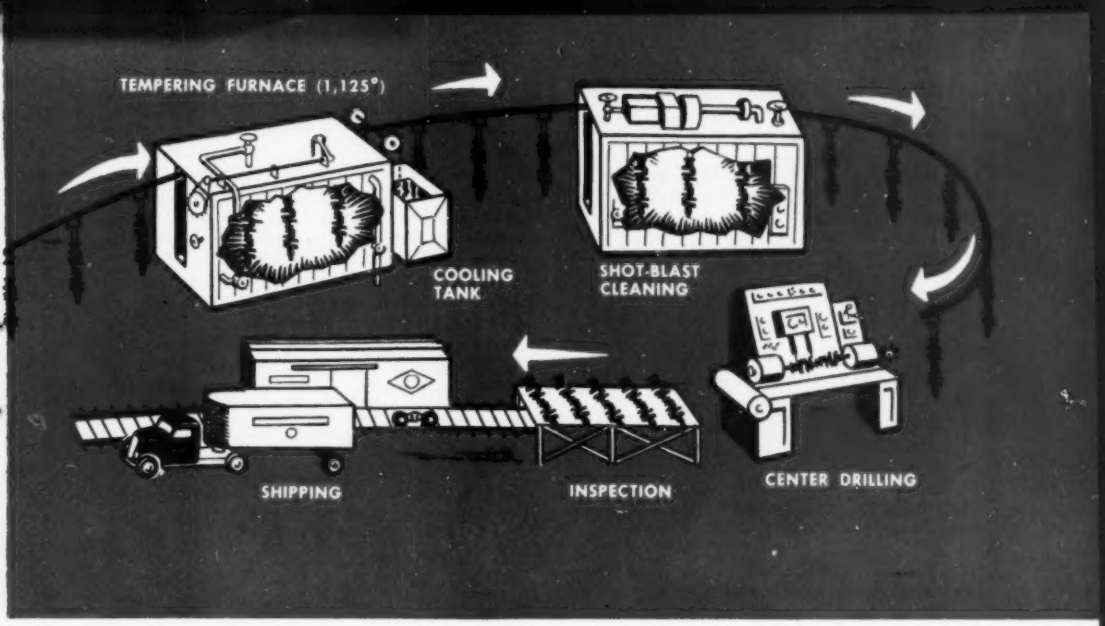
The pace has quickened now. In seconds, a billet navigates the de-scaler and strikes a trip which sends the first dies into action. These are in a reducer—two rolls that crush the hot billet between them to distribute the steel into the rough positions needed for forging.

The crankshaft-to-be shoots through the roll dies at high speed and comes

FORTY "ELECTRIC BRAINS" like the one shown below, all interrelated, direct the automated lines that machine and process engine blocks and other parts at Ford's new Cleveland plant.

PARADE OF BLOCKS, en route from one machine to another, marches along a broadside shuttle to automatic turntable (arrow) where they are positioned for lengthwise shuttle.





face to face with its first electric eye. The eye winks and into action goes an air-driven piston. The billet flips end for end and is ready for the press.

Up to this point, no man has done anything but watch the work.

Twelve Million Pounds of Pressure

Now a press operator tongs the billet into the first forging die. A touch on the foot button and 6,000 tons of pressure descend and rise. Six thousand tons—but it might be a rubber stamp for all the jar you feel. The steel flashes briefly into flame, then is tonged into the second die for the strike on the other side.

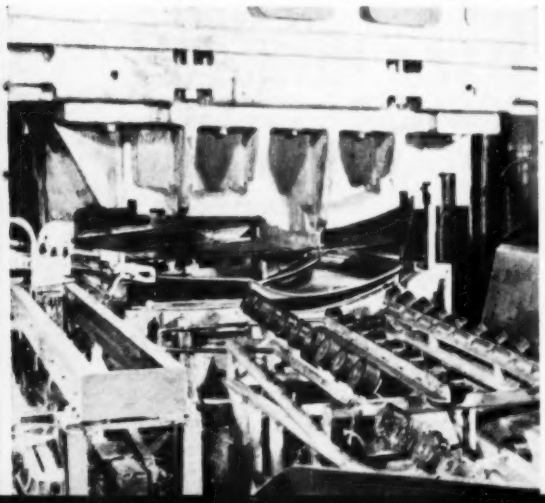
After the second strike, the operator slides the forging to a conveyor at the opposite side of the die. It rides to a smaller trim press, where another worker jogs it into the trim die which shears off the ragged ruffle of waste around the edges. Waste goes through an opening in the floor. The crankshaft is tonged to an overhead trolley and placed, still red-hot, in an upsetter machine that flattens one end of the crank into the flange which will eventually link the shaft to a flywheel. A trolley carries the shaft to still another press for a re-strike to make certain of correct alignment.

Now the shaft is ready for heat-treating. It is placed in a rack, picked up by an overhead conveyor and moved through an air-cooling zone to the hardening furnace. Hanging four to a carrier, crankshafts enter the furnace at three-minute intervals on a monorail. One hundred minutes later, on the nose, they emerge from the 1,550° heat and are plunged automatically into a quench tank.

Water, held at a constant 90°, circulates around the cranks for 70 seconds. An elevator lifts the carrier back to the

[Continued on page 258]

AUTOMATIC FEEDING and extraction of body parts is a feature of Ford's Buffalo stamping plant. Here a mechanical hand (left corner of press) pulls a rear-door panel out of the die.



P.S.

Last minute news & notes...

AN ANTI-MALARIA DRUG more powerful than any other known--including chloroquine, currently used in Korea--is reported by U. S. Public Health Service experts. The new lifesaver is pyrimethamine, called Daraprim by its maker, Burroughs Wellcome and Co.

OUR SOLAR SYSTEM has a newly discovered member--an additional moon circling the largest planet, Jupiter. This makes 12 moons for Jupiter. The latest is estimated to be a tiny satellite only 14 miles in diameter.

A RECORD STORE OF THE FUTURE may work like an Automat restaurant. You'd bring in a reel of blank or used sound tape, place it in a machine, deposit a coin,and have the latest song hits transcribed upon it, predict physicists of Armour Research Foundation. When you tired of them, you'd return with the reel and have the old tunes erased and newer ones substituted in the same way.

HELICOPTERS, already used successfully for locating whales, have now been armed for the kill. They will fire a rocket missile that dispatches the whale and then explodes a gas bomb to keep it afloat until a boat gets there. Norwegian whalers are currently trying out the innovation.

BIGGEST SINGLE BLOCK OF POWER ever supplied by the electric industry, 2,200,000 kilowatts, will be used by the AEC's new gaseous-diffusion plant near Portsmouth, Ohio, for making uranium 235.

WORMS NOW TRAVEL BY AIR from Nova Scotia to the U. S. In season, more than 100,000 blood worms from tidal mudbeds are imported monthly for fishing bait.

THE BIBLICAL STORY OF CREATION has new and striking scientific evidence on its side, reports Prof. Edward McCrady of the University of the South. Modern study indicates that all known elements in the universe came into existence practically at once--within half an hour or so. Before that time, there could have been no chemical elements at all. Dating studies, based on the radioactive decay of uranium,fix the date of that awesome moment of creation as about five billion years ago.

A "JET CARPET," developed in England by Shell Petroleum, is reported to solve the urgent problem of protecting tar-covered surfaces at airports from the heat and blast of jetplane exhausts.

FIFTY OLD FREIGHT CARS will be renovated daily, in assembly-line fashion, by a $12,000,000 Pennsylvania Railroad shop to be completed next year at Hollidaysburg, Pa. Moving along one of three lines in the half-mile-long shop, a worn and battered car will be repaired, sandblasted, repainted, dried by infrared lamps and sent on its way as good as new, all in a single day.

"ODOR-BLINDNESS" may be more common than color-blindness, according to Dr. R. Pantaleoni, perfume chemist.

AN ATOMIC-POWERED OIL TANKER of at least 10,000 tons is expected to attain the phenomenal speed of 30 to 40 knots. Norway and the Netherlands, co-sponsors of the Dutch-Norwegian Nuclear Research Institute near Oslo, plan to build the ship jointly and launch it within five years.

SEA LEVEL the world over is five inches higher than it was in 1895, says Dr. George F. Carter, Johns Hopkins University geographer. Because this is the tail end of a glacial period, polar ice is melting and filling up the oceans. Future harbor works should be planned for an expected sea-level rise of 24 inches within the next century, Dr. Carter advises.

The Editors

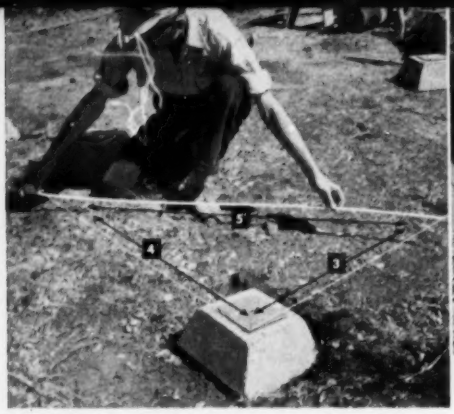
How to Build a Cabin for $200

Vacations and lazy week ends aren't far away. This peanut-priced hideaway is fun to build, and you don't have to be a carpenter.

By Jerry Parker

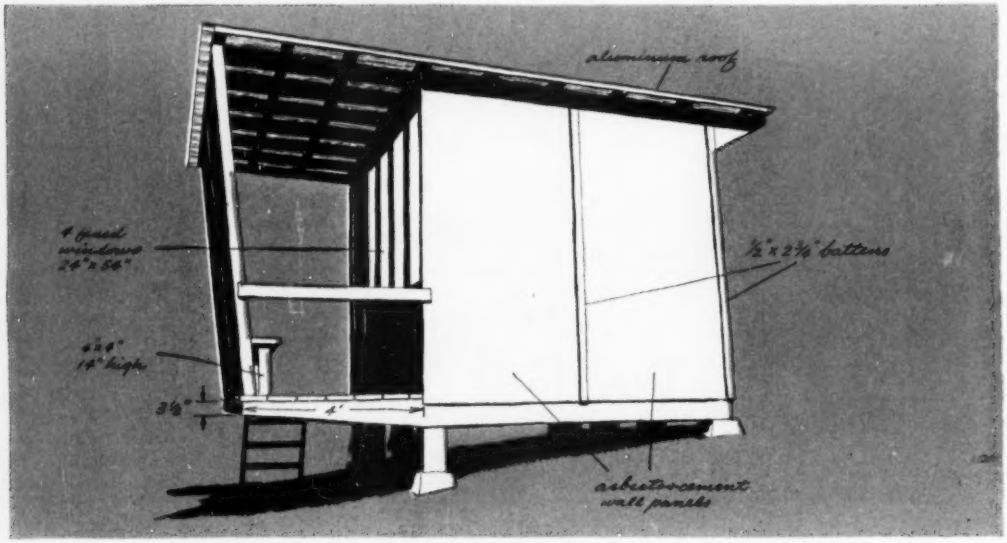
WITH a burning desire for a snug little cabin all our own, we counted our spare cash. It came to $200. Three working week ends later we were broke but owned this cabin. We didn't knock ourselves out building it, either. It was hard work but the enjoyment we got out of it kept it from being hard labor.

True, it's no place for throwing cocktail parties for 40 people—the floor area is only 12′ by 12′, and 4′ of that is porch. But it's a wonderful spot for the three of us to



1 FOUNDATION is eight concrete piers. Corner ones were set out 8′ and 12′ apart and string run tightly between them. To square corners, string was marked 3′ and 4′ from each corner and piers adjusted until marks were 5′ apart. Then other piers were set.

2 POSTS were needed at front. The four girders were taper-sawed and rested on piers in back, held up level over front piers to determine post length. (Taper starts 4′ from front, runs to 3½″ width at front.) Scraps made diagonal braces for posts.

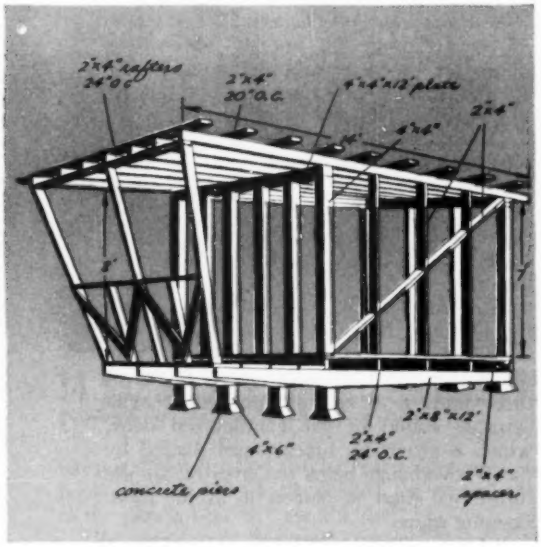


5 BUILDING PAPER was stapled over joists and spacers. Stapler speeds this job, and many lumberyards will rent you one by the day.

6 FLOORING is three 4′ by 8′ panels of ⅝″ plywood. Being reject grade, we got them for $14. Budget permitting, we'll add tiles.

3 HEADER is a 1″ by 8″ board that neatly boxed in the rear ends of the girders and also braced them. The front ends of the girders were boxed in by a one-by-four. Galvanized nails were used throughout the cabin to lessen the chance of rust stains developing.

4 FIVE JOISTS are 12′ two-by-fours on 24″ centers. Spacers between joists on girders are needed to support flooring solidly.



7 SOLE PLATES (sills) were nailed down in asphalt roof cement to seal out moisture. Diagonal measurements square corners.

loaf in on lazy week ends. If you like to hunt or fish, something like this would make an ideal base of operations. In the snow country it could make a fine ski hut. On a corner of your property it would serve nicely as a guest house, studio-workshop or a de luxe play house for the kids.

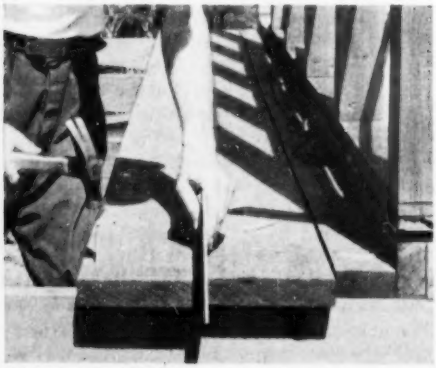
Nor do you have to be a carpenter to make one like it. The construction we used is simple, modern and straightforward: fir and redwood framing, asbestos siding, plywood flooring, aluminum roofing. To make building it easier, we put in fixed windows and louvers to take care of the ventilation. We made up the plans as we went, and they were the stub-pencil-on-the-back-of-an-envelope variety. If you can saw a board and drive a nail, you can build a cabin like this—and have fun doing it.

The $200 gave us the walls, roof and deck. We are slowly making interior improvements on a pay-as-we-go basis. Insulation, built-ins and a tile floor are on the docket next.

Our $200 went something like this:

8 FRONT STUDS, 8′ high, and plate are four-by-fours. They were rabbeted to take 24″ by 54″ sheets of double-strength glass.

9 CORNER STUDS at rear are 7′ doubled two-by-fours, as is plate. Other studs are two-by-fours. Temporary braces held corner.



10 PORCH FLOOR is 2″ by 8″ planks nailed to girders with galvanized spikes. Scrap of 3/16″ asbestos panel was used as a spacer.

11 RAFTERS are undressed two-by-fours on 24″ centers. I didn't notch rafters for plates; they seated well at 1′-in-14′ roof pitch.

$80 lumber
$35 asbestos-cement wall panels
$35 aluminum roof
$14 plywood floor
$20 window glass
$184 total

The remainder went for stain, hardware and paint.

Shopping pays. It's worth-while to shop around for lumber. Visit different lumberyards and compare their prices; scout out sources for secondhand lumber. We used redwood for studding and fir for roof boards. A better grade of redwood went into the deck and front 4′ by 4′ studs, where it shows. I like redwood because it's practically weatherproof, good-looking and easy to handle. If I'd used fir throughout, I probably could have built the cabin for $150 or less.

Watch for sales in building materials. Asbestos-cement panels usually cost about 15 cents a square foot but we've seen them offered at 12. Ordinarily aluminum roofing is around 20 cents a square foot but we bought ours at 14.

Don't be afraid to buy cheap, green lumber. Some lumber dealers sneer at the low-cost grades and call it chicken-coop stuff. If you're worried about shrinkage (we weren't, particularly), you can always stack your lumber for air drying and let it season a few months.

How big? If you are working to a tight budget, don't forget that space costs money and work. Our 8′ by 12′ inside area may sound like close quarters, but our family of three finds it a comfortable retreat. The extra 4′ added by the cantilevered deck, which is swept by breezes and shaded by the 5′ overhang, helps out greatly. In the future we plan to screen it in for more sleeping space.

Being an amateur is a help rather than a handicap on a job like this, because you don't have set notions to discard or pro standards to keep up. If a wall isn't absolutely plumb or a corner exactly square, just keep mum about it. The cabin will still be stoutly built, weathertight and good-looking.

We enameled the asbestos wall panels, though they don't actually require it. The enamel, a green, synthetic type, was on sale for $5 a gallon at our local lumberyard. We figured at this price we couldn't go wrong. We stained all the exposed wood.

The joints between the asbestos panels were calked and covered with ½″ redwood

12 **SIDE STUDS** are two-by-fours on 24″ centers. Three were used on each side. They were notched into the outside rafters.

13 **ROOF BOARDS** are fir two-by-fours that rest flat across rafters on 20″ centers. Two-by-twos were nailed to roof-board ends.

14 **DIAGONAL BRACES** were nailed between studs in each side wall. Braces are scrap two-by-fours, run from sill to top corner.

15 **SIDING** is 4′ by 8′ asbestos-cement panels 3/16″ thick, trimmed to size by scoring along a straightedge and snapping off.

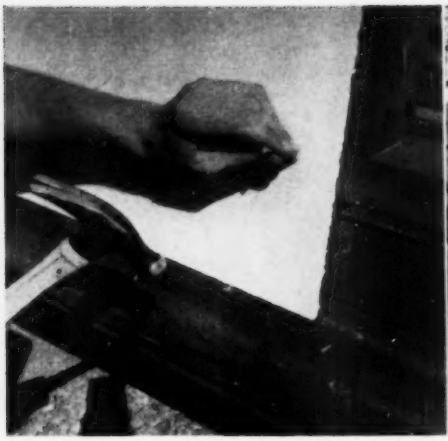
battens 2¾″ wide. We also battened the two back corners of the cabin so that the edges of the panels wouldn't get chipped.

Big windows. For some reason, many cabins feature peephole windows. This doesn't make sense to me, so I put in four big fixed windows, each 24″ by 54″. They cover most of the south wall and almost make a solar house out of our unit. Ventilation is supplied by three hinged louvers at the top of the back wall and by the combination screen door.

When ideas occurred to us in building we incorporated them right on the spot. For instance, when the deck was finished there seemed a need for a bench, so we put a 2′ by 8′ plank along the rail and supported it with cutoffs from studding. A 24″ by 30″ table was hinged to the end rail. The table hangs out of the way when not in use. When up it's supported by a piece of closet rod.

A bottle cap tacked to the underside of the table holds the rod firmly at the top and the bottom fits into a shallow hole drilled in the deck.

Building the cabin was mostly a hand operation. In the way of shopwork, the front 4″ by 4″ studs, plate and window sills were rabbeted to receive glass sheets. A three-panel door, which is screened on the front, has three removable squares of asbestos cement held in rabbets with turn buttons. We also made half-lapped 2″ by 2″ frames for the three back louvers. The louvers are 1′ high, approximately 4′ long and faced on the inside with asbestos cement. A power saw was used to cut battens out of some



16 PANELS were fastened with galvanized nails. Scrap of board tacked to frame of cabin held panel as it was nailed to studs.

17 POSTS AND RAILING of porch are two-by-fours. Posts slant out to meet roof. Angle at bottom of a post is being taken in photo.

½″ by 5½″ boards and to make ¾″-square window stops.

A cabin like this will give good service in any part of the country. Ours has been tested in California's torrid heat and heavy rains and passed these trials nicely. If you're building in heavy-snow country, some modification in line with local practice may be in order. If you are building in heavy-frost country, you had better sink the piers below the frost line or frost heaving may damage your cabin. (See PSM, April '51, p. 184, for details on casting frost-resistant piers.) You can also make your roof a solid deck with asphalt paper underneath the aluminum.

Maybe you'll want to increase the pitch of the roof. Ours slopes from a little over 8′ at front to 7′ at back. However, the kind of corrugated aluminum roofing we used will stand a load of 72 pounds per square foot on a 24″ span, so we'd build the same way even in the High Sierra.

Our cabin is heated by a tiny airtight stove. For lighting and cooking we depend on kerosene lamps and a small Coleman stove. Sketchy conveniences? We don't think so at all. We think our own cabin is out of this world—and it's a swell place to be. END

18 ROOF is corrugated aluminum. Sheets are 26″ wide and were lapped two corrugations at sides and 12″ at ends.

19 EXPOSED WOOD was stained a rich red. Table, hinged to rail, hangs down out of way. Scrap lumber supports bench.

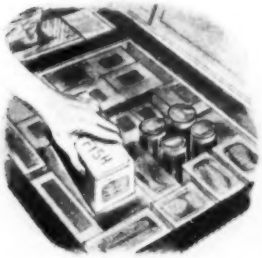
Six Things You Can Do When a Home Freezer Quits

How to stop spoilage if the current or cooling unit should fail.

1 Keep freezer closed. Curiosity as to what's happening inside doesn't pay. Opening the lid or door for only a brief interval will speed up thawing sharply. If a storm is predicted and power failure is frequent in your community, it's good insurance to lower the temperature-control setting. Set it for 10° to 20° below 0°, which is the normal temperature. Food will then stay frozen longer without power. There is no danger so long as freezer is below 15°.

2 Transfer food to a commercial locker plant if it is operating and has space. To move food, wrap in newspapers and blankets or use insulated boxes.

3 Use dry ice if you can get it—and if locker space isn't available. In average freezer, 50 lb. keeps 15° temperature two days. Put heavy cardboard on food, dry ice on cardboard. Dairy or cold-storage plant may sell you the dry ice. Lacking dry ice, check temperature outdoors—it may be cold enough to store food there. Or maybe you can just open the window, cooling the entire room.



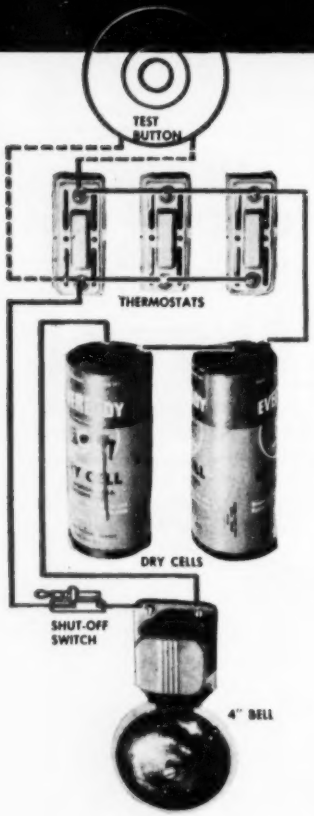
4 Keeping freezer full is sound operating procedure, even though you stand to lose more. In a fully loaded cabinet, food usually will stay frozen two days; in a cabinet with less than half a load, not more than a day. Department of Agriculture tests in a warm room show that in a well filled, well insulated freezer of more than 12-cubic-foot capacity, food will not begin to spoil within five days.

5 Covering the freezer with blankets or quilts will increase the insulation, but don't block the air vents. Crumpled newspaper or excelsior between the blankets and freezer will help.

6 Refreeze thawed food quickly when the emergency is over—*if you are sure it hasn't spoiled.* Taking the food to a commercial plant for refreezing is best. If you do it at home, move some colder packages to refrigerator while you refreeze the rest. For quickest freezing, pile packages so air can circulate around them.

Your Own Fire Alarm May Save Your Home

You needn't be an expert to install a system that will protect the lives under your roof.



BASIC CIRCUIT is this simple. Hook up as many thermostats as needed, keeping all runs of wire as short as you can. A test circuit (dotted) can be run from any one thermostat to a push button. The alarm should ring when the button is pressed. A switch near the bell is desirable to shut off the alarm once a thermostat has set it off.

By Harry Walton

THE odds against you go up every minute a fire is undiscovered. Early warning is one of the best personal fire-insurance policies you can buy.

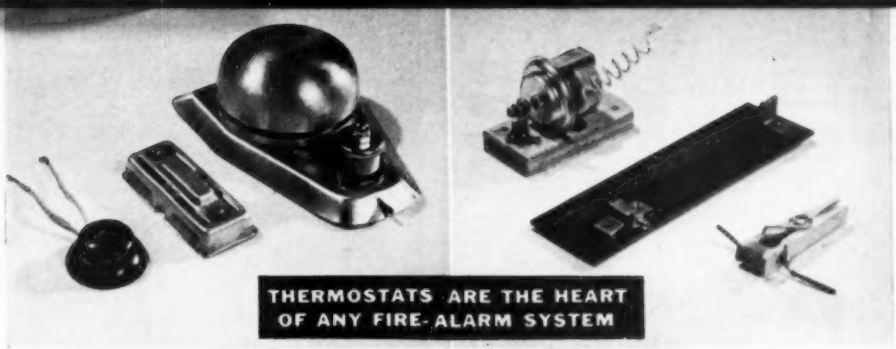
You can sleep more soundly if a good fire-alarm system is standing guard. By rousing you in time, such a rig can make all the difference between incident and disaster. It can give the family time to get to safety, enable you to use what fire-fighting means are at hand, and give you a chance to call for help before things go too far. Such timely warning can be especially important if you live in the country at some distance from the nearest fire company. But in town or country, a working fire alarm can be a lifesaver.

Open versus closed systems. At its simplest, a fire-alarm circuit consists of a current source, one or more open thermostatic switches in various parts of the house, and an alarm bell, as shown at the left. Any abnormal rise in temperature closes the thermostatic switch, making the bell ring until current is shut off manually. Because all the thermostats are connected in the circuit in parallel, the heating of any one of them will sound the alarm.

A closed-circuit system has thermostats that normally remain in the closed or current-conducting condition, but open to break the circuit when heated. They are connected in series like the links of a chain, and current normally flows through all of them into a holding relay, which holds a separate bell circuit open against spring tension. Heating any one thermostat will break the relay circuit. The relay spring then closes the bell circuit and the alarm rings.

Such a closed-circuit system will give warning by ringing if a wire is broken, a thermostat connection is loose or the cutoff switch is left open. It will not warn of current failure unless the bell circuit has its own current source in the form of dry cells. A constant-duty transformer must be used for the thermostat circuit, because dry cells would quickly be exhausted.

Heat-sensitive elements. Thermostats for fire alarms can be bought ready-made at modest prices, and several are shown in the accompanying photos. You can make your own by using clothespins, bimetallic strips or parts of old



YOU CAN BUY THERMOSTATS like these, usually in sets with or without transformer and bell. The two at left above must be connected to an electric-bell circuit, but big unit at the right has a nonelectric mechanical bell.

THESE YOU CAN MAKE. Topmost unit is built around an auto-radiator thermostat. The center one makes use of a homemade bimetallic strip. Simplest is the clothespin type. Wax button softens when hot, lets contacts touch.

auto thermostats, and check them in the kitchen oven.

The simplest kind consists of a spring clothespin with a contact set in each jaw. The jaws are held apart by a bit of wax, which of course melts under heat, letting the contacts touch.

Candle wax can be used in cool locations, such as parts of the cellar distant from the furnace, but may give a false alarm during hot weather when used elsewhere. Sealing wax is more suitable. Still better is a bit cut from a fusible link. Such links are sold for use in automatic sprinkler systems.

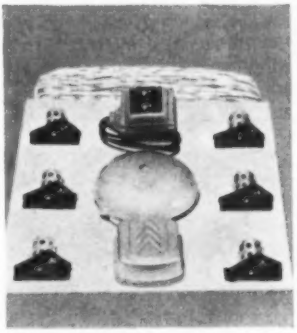
A good unit for the attic or other warm locations can be made from a bellows-type auto-radiator thermostat as shown in the photos. Another kind uses bimetallic strips cut from the spiral type of auto thermostats or made by riveting together a piece of steel and another of copper. This kind can be used for open or closed systems simply by locating the contact screw on the proper side of the bimetallic strip.

To check thermostats, wire one at a time in series with a dry cell and a flashlight bulb. Put the thermostat in the kitchen oven, turned on low, with a dependable thermometer alongside it. Adjust the thermostat so that the bulb lights (or goes out, if you're building a closed-circuit system) at about 20° above the prevailing summer temperature of the location where the unit is to be installed. Near the furnace or over a kitchen range a setting as high as 160° may be necessary to prevent false alarms.

Current sources. The cheapest and most convenient power source is a bell transformer. Its disadvantage is that a power failure puts your fire alarm out of commission.

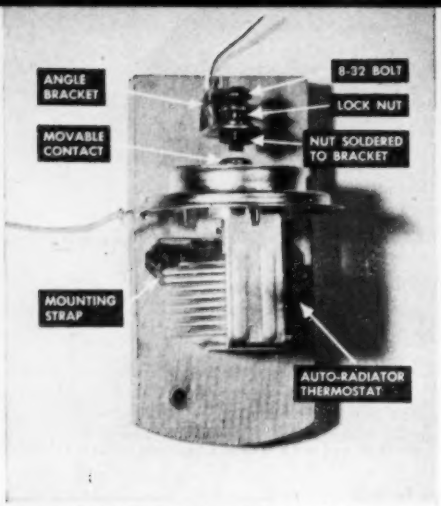
Dry cells are of course independent of power lines. Use two or three of the large No. 6 size, or a "hot shot" unit. Since they deteriorate in time, they should be replaced once a year to insure dependability.

Installing the system. Mount the alarm bell where it can be heard loudly enough in bedrooms to wake sleepers, and will be audible during the day everywhere in the house. The upstairs hallway is usually a good place. Thermostats should be located as high in the rooms as possible, at the head of cellar and hall stair wells, in the attic near the

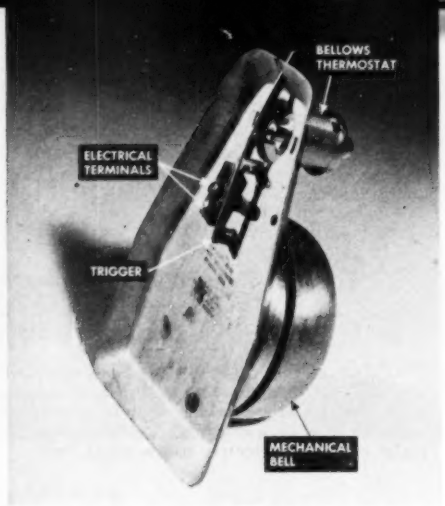


FIRE-ALARM KIT complete with transformer, gong and six thermostats sells for about $25 (Hal Golden, 30 Central Park So., NYC 17). A similar five-thermostat and bell set, without transformer or wire, costs about $15 (Harmony Brass Co., Plano, Ill.)

TEST HOMEMADE UNITS one at a time in the kitchen oven, using a reliable oven thermometer. Connected to a dry cell and a flashlight bulb, the thermostat should light up the bulb at 125° to 160°, depending on where you will use it.



AUTO-RADIATOR THERMOSTAT, sold for use with alcohol antifreeze, opens at 153° and makes a good unit for the attic, over the furnace, other warm spots. Solder one wire to thermostat frame, one to contact bracket.



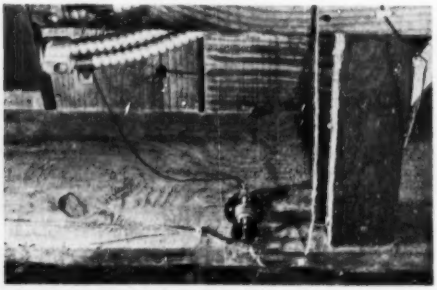
WIND-UP ALARM has mechanical bell that is tripped by bellows thermostat. This also closes a switch that can be connected to a distant electric bell. Made by Elmac Inc., Seymour, Conn., the unit retails at $7.50.

PORTABLE UNIT, a self-contained alarm, was assembled by writer for use near a temporary fire hazard. It hangs from ceiling molding, can be used near such risks as portable heaters, painting supplies or party decorations.

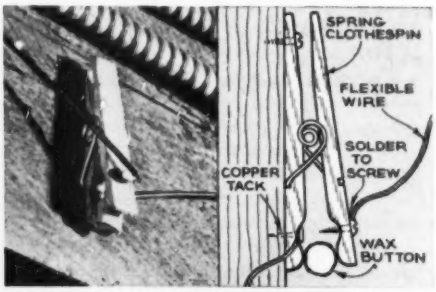
chimney, over the furnace, near the kitchen range and wherever an unusual fire hazard exists.

Plan your wiring on paper first, noting where you can most inconspicuously drill 3/16" holes through walls and ceilings to pull the wires through. Use 18-gauge twisted

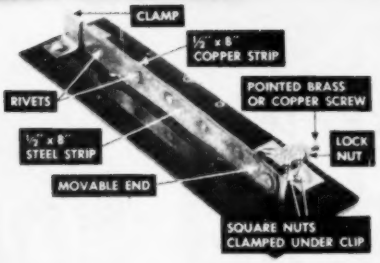
GOOD SPOT for a thermostat is at head of cellar steps, where heat from a basement fire would rise. Since furnace heat normally keeps this area warm (or even hot, if furnace runs for heating water in summer) a unit set at 150° may be used.



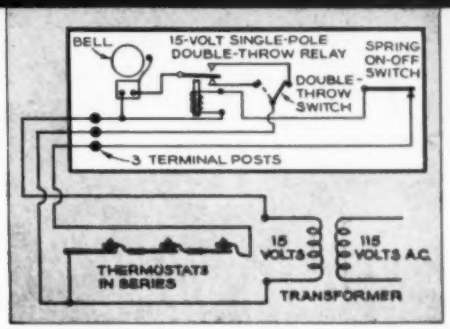
YOU CAN SAVE WIRE by grounding one side of thermostats to BX cable, pipes or the shells of electric fixtures, if yours is a battery system. This saves one wire, but isn't recommended if you use a transformer for power.



CLOTHESPIN HEAT DETECTOR is suitable only for cool locations. Be sure to mount it vertically so that melting wax won't foul the contacts. Turn in brass screw far enough to touch other contact well before jaws close.



BIMETALLIC STRIP will bend toward its steel side when heated. Join a copper and a steel strip with rivets spaced 1" apart. Mount firmly at one end on a nonconducting base and fix an adjustable screw in a bracket or clip near the other end. With the contact on the copper side as above, the circuit is normally closed, opening when heated, and unit is for use in a closed-circuit alarm system like that shown at the right. For an open-circuit system, mount the screw on the steel side, using a copper rivet in the strip as the moving contact. A bimetal strip cut from a spiral auto thermostat can be rigged the same way.



CLOSED-CIRCUIT SYSTEM rings bell not only if there's a fire, but also if thermostat wiring is broken or switch left open. This one was devised by W. H. Fogle of Beech Grove, Ind. Any number of normally closed bimetallic-strip thermostats are wired in series. If one opens, the circuit is broken and the bell rings. Test switch should be a normally closed spring type, open only when held. Pressing it releases relay and rings alarm to check the system. Double-throw switch is for turning off the alarm when you have to. It should be thrown back to reset the system, but if you forget, bell rings again as thermostats cool.

bell wire or rubber-covered lamp cord, holding it with insulated staples. Scrape ends bright, twist all joints tightly and solder if at all possible. Tape well.

If you use BX cable, fixture shells or water pipes as one side of your line, be sure connections are secure. Don't trust to simply wrapping the wire around, but fasten it under screws or with straps or clamps.

In a two-story house with attic and basement, there are actually four floors to cover. It may be simpler to use two separate alarm systems rather than run one through the entire house. END

Watch Out... in FEBRUARY for fire.

After falls, fires cause the largest number of deaths and injuries in the home. Twenty lives a day are lost in the U. S. in domestic fires, and in February this tragic record usually gets an added boost.

FIGURES of the National Safety Council show you will probably not have one of the 600,000 fires expected in 1953, if you (1) don't smoke in bed; (2) keep matches in a safe place; (3) keep electrical equipment in good shape; (4) put rubbish in metal containers; (5) keep chimneys in condition; (6) don't dry-clean with inflammable liquids; (7) destroy oily rags. Some fires result from causes beyond human control. But Lloyds of London offers good odds that you won't become a fire-insurance statistic if you take all the steps listed above.

How You Restore a Model T Ford

Six Months of Loving Work Put This Tin Lizzie on the Road Again

By R. P. Stevenson

LATE in May, 1927, Henry Ford closed up shop temporarily and called it quits on his famous Model T. The final T bore serial number 15,007,033. It marked the end of 19 years of production. Some people today call it the end of an era.

But it wasn't the end of the Model T. A quarter of a century later a few tin lizzies still chug along mountain roads and through remote farm lands, proudly bearing this year's license plates. Others have come upon dark days, in old barns, in the rear recesses of garages, in junkyards. But their future now looks brighter, for car fans are seeking them out in increasing numbers to restore as a hobby.

This is the story of how one Model T was restored, how it came back to life to shine again in original splendor and breathe its gasoline once more with pleasant little wheezes. It is the story of the new life and times of old No. 10,795,848, a two-passenger runabout built in late November, 1924, but registered as a 1925 model.

It Showed Its Age Badly

The runabout wasn't very pretty when I first saw it. Twenty years in an unroofed barn had seen to that. Rust flaked from the body, fenders, aprons, running boards, hood and instrument panel, and blanketed the engine. Daylight showed through the fend-

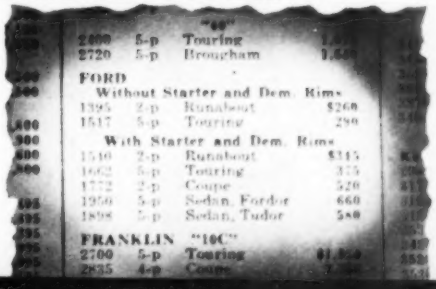
ers. Fabric dangled in crazy tatters between the wood bows of the buggy top. Generations of mice had nested in the seat and backrest.

To see a fully restored and gleaming Model T in such a tangle of rust and wreckage takes plenty of vision. You also need patience and time, as well as a certain amount of money—but not nearly so much as the rich collectors sometimes lavish on rare makes. The Model T is the poor man's antique.

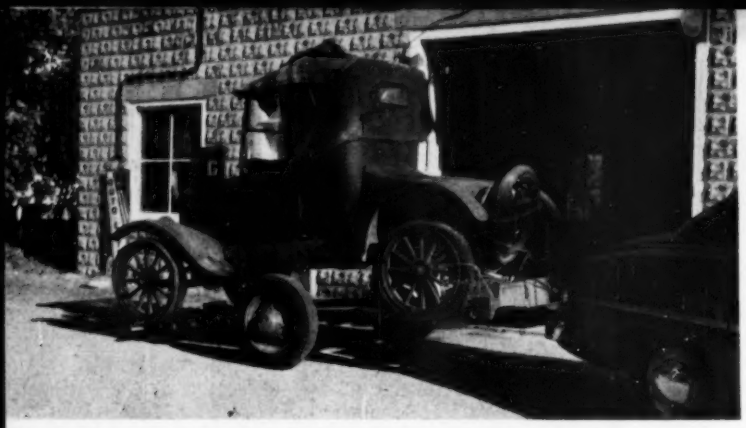
I paid $20 for the runabout. When I dragged it out of the barn down the road from my home in Hunterdon County, New Jersey, some people were frankly skeptical. What, they wanted to know, would I do with it—just supposing it could be fixed up? Where would I get the parts?

These questions indicate a practical viewpoint. But they do not take into account the enthusiasm that exists among confirmed T-men, an enthusiasm sparked, as likely as

F.O.B. DETROIT. A de luxe model with starter and demountable rims, the 1,540-lb. runabout cost $345 new in 1925.



		"60"	
2800	5-p	Touring	[illegible]
2720	5-p	Brougham	[illegible]
FORD			
Without Starter and Dem. Rims			
1395	2-p	Runabout	$260
1517	5-p	Touring	290
With Starter and Dem. Rims			
1540	2-p	Runabout	$345
1662	5-p	Touring	375
1772	2-p	Coupe	520
1950	5-p	Sedan, Fordor	660
1898	5-p	Sedan, Tudor	580
FRANKLIN "10C"			
2700	5-p	Touring	[illegible]
2835	4-p	Coupe	[illegible]



FIRST RIDE IN 20 YEARS took the 1925 Model T runabout (it's *not* a roadster) to the garage where it was to be restored. Like that joke of Model T vintage says, its 30-by-3½ tires were only flat on the bottom.

not, by a nostalgia for cars as they used to be.

By modern standards, a restored Model T doesn't offer much as a practical everyday car. If you used to drive one, you may be surprised, as I was, at how slow it now seems. And you will realize once more that the wit of long ago spoke truth in saying that a Model T's only shock absorbers were its passengers. It rides harder nowadays than an MG.

The Payoff Is Pleasant

But when the job is done, there will come sunny days, free afternoons when you crank up the T, tell your family or best girl to pile in, and set off just for a ride, headed nowhere in particular. Or maybe you'll have a destination—to show off your new buggy at an antique-car club meet or in a parade. As you ride, you'll get a kick, as everyone does, out of how high you sit above the ground. And when you start down a familiar hill, you'll be surprised at how steep it suddenly seems—when viewed from the front seat of your Model T.

As a hobby, working over a dilapidated Model T offers plenty of stimulation for those with mechanical inclinations. If you run into difficulties, somewhere in your neighborhood there undoubtedly is a veteran mechanic who can straighten you out. With luck, you might even find a man as competent as Charley Case of Annandale, N. J., who overhauled my runabout mechanically from crank to tail light.

Only a few parts are made new for Model Ts these days. I had to hunt hard for some necessary items. But looking for parts can be as interesting as actual restoration work on the car.

On two occasions, the hunt carried me back to horse-and-buggy days—once to a harness shop to have the leather fan belt stitched, and again to buy a pair of hame straps. Shortened a bit with new holes punched, the hame straps worked out perfectly as hold-down straps for the new top when it was thrown back.

During this hunt, I found, too, what a conversation piece a Model T can be. Everyone over 35 seems to have a story to tell

CHARLEY CASE, who brought the T back to mechanical perfection in his garage at Annandale, N. J., tries the seat for size and gives the rotted top another rip.

RUST EVERYWHERE—even on the dash. That scrap of paper on the far corner of the windshield was part of the original instruction sticker for owners that new cars used to have.

about his exploits with a Model T. In fact, I have one of my own—how I first drove a Model T, about 1919, using a wire fence staple as a substitute for the old-type ignition key.

Staple Just as Good

I don't know how I happened to discover this. Just experimenting, I suppose. But the two prongs of the staple I had sorted out of my pocket slipped right into the ignition lock down on the coil box.

I had gone with two older brothers that day to the far end of the farm in the family flivver. While they attended to some chore, I waited in the car. It was still new and *very* intriguing. I wanted a chance to shove down the three pedals and manipulate the spark and gas levers in a bit of make-believe driving.

When the staple turned on the ignition, I had all the elements of something far more exciting than mere make-believe. I had never driven a car, but I had watched. My brothers were over the hill, well out of sight.

I gave the crank a jerk. The engine took off. Climbing behind the wheel, I did, too—in a big circle around the field. I was still a bit breathless when my brothers returned. I wondered whether they would notice that the flivver wasn't parked in quite the same spot it had been.

RECOGNIZE THIS? Until 1919, all Model Ts had identical ignition keys—and this was it.

This story has a sequel, too. My brother, it developed, had lost the ignition key. After awhile and still wondering whether I should part with such a useful bit of information, I made the discovery again about that staple. It got us home.

There was also the chap who had driven all the way from Los Angeles to the outskirts of New York without trouble—quite a trek in Model T days—when a horrible clatter started up under the hood.

Two Blades Are Enough

A look showed one of the four fan blades missing. It was not the lost blade that was causing the clatter but the remaining three. The driver dug out his tools, broke off the blade opposite the missing one to balance the fan, and drove on into the city with the motor purring sweetly.

Model Ts were rugged. They were built

REMOVING CYLINDER HEAD was easy, for someone had lifted the cap screws. But nothing else was missing. When juice was applied, horn gave out its characteristic *bur-r-r-r*.

to take it. I heard a story about that, too—from the farmer in whose swamp I finally found a pair of top rests, the projecting brackets that support the bows while the top is down. I pulled the rests from one of several derelict Ts junked in the swamp.

"The Model T truck was parked there in front of the barn," the farmer said, indicating a sloping, downhill area. "I was unloading some feed. When I came out the door, the truck was gone.

"I ran around the corner. There it was—still bouncing down the hill. It broke through three fences, knocked down a couple of small trees and finally stopped in a plowed field over yonder. I went down and drove it back. Nothing wrong except a bent fender."

I hear stories like this every time I set out in the runabout, now fully restored. The car still is not exactly pretty. That never was the adjective to apply to a tin lizzie. But it has plenty of character. The engine purrs in steady contentment to the regular clicks of the coil vibrators.

Everyone wants a ride—with a few exceptions. One man looked and admired, but rather reluctantly. He refused an invitation to drive her, wouldn't even take a ride. Said he had had a bellyful of Model Ts, more than enough to last him a lifetime. There *are* people like that, for the Model T—like Franklin D. Roosevelt—had both partisan followers and bitter detractors.

Despite its original looks, the runabout was still in good mechanical condition when

EVERYBODY LOVES A PARADE, they say, and when you own a restored Model T you're sure to be invited. Here's the runabout in 100th anniversary parade at Annandale, N. J.

I bought it. It had been driven very little. Charley Case first noticed one sign of this. The spring hangers still rode high, with a full finger's clearance between their lower edges and the axle. These hangers were always among the first parts of a Model T to grow tired from use and age, eventually sagging down to the axle and sometimes scoring it deeply.

Along with the runabout, I got half a truckload of parts. The old barn would have been a treasure house for any Model T fan. It was plain that the original owner had loved to tinker with cars, urged on perhaps by the 1920 copies of POPULAR SCIENCE MONTHLY that lay nearby.

Since restoration of the runabout was to be sponsored by PSM, three staff members joined me one sunny day last spring to move it to the repair shop.

Using a winch, we dragged it onto a trailer. Incidentally, it is never advisable to tow a Model T, even in neutral, for there is too much chance of damaging the transmission. If a tow truck is used, roll it on the front wheels.

Charley Case, proprietor of the Annandale Garage, was waiting to see what sort of critter this was descending upon him.

This Man Knows His Ts

Actually, he knew pretty well what to expect, for I eventually discovered that he has worked on each annual example of the Model T ever made—from the 1909 models (which appeared in 1908) to the final '27s with their lines so strongly suggestive of the forthcoming Model A.

As we loosened the tie chains and rolled the runabout down off the trailer and over to the corner where it was to experience a rebirth in the coming months, he recalled one of the many Ford jokes that were prevalent in the heyday of the Model T.

"You know why it was called a runabout, don't you?" he asked, holding his hands about three feet apart. "Every time it was fixed, it would only *run about* this far."

But that is pure libel. The runabout never gives up—well, *almost* never. END

Next month: How to overhaul a Model T engine.

Where Do You Get Parts?

SOONER or later, every bystander pops out that question when you start restoring a Model T.

Ford dealers long established in rural areas are one good bet. Some may even have body parts, fenders, splash aprons and such.

Mail-order catalogues may have what you want, too. Recent catalogues list these parts: Sears, Roebuck & Co.—spark plugs (⅜" pipe thread), transmission bands, pistons, piston rings, piston pins, timing gears, valves, ignition coils and points, gasket sets, front-wheel bearings; Montgomery Ward—30-by-3½ clincher tires and tubes, fan belts, timers, coils and points, gaskets, pistons, expander piston rings, timing gears, front-wheel bearings.

William Scharff, 1322 Myrtle Avenue, Brooklyn, N. Y., has a good stock of factory parts—no body parts.

Classified advertisements in magazines and antique-car-club journals also may list what you need.

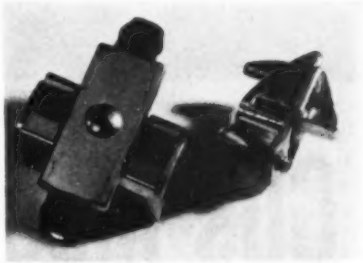
Making Driving Safer

These new accessories will improve your chances of steering clear of mishaps on the highways.

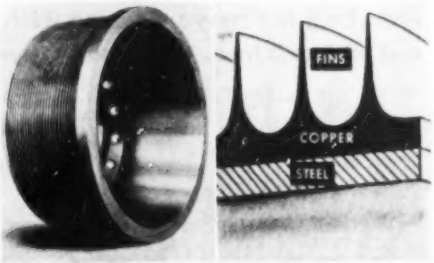
Loss of brake fluid will be brought to your attention immediately if you install this indicator. Substituted for the filler plug in the master cylinder, the indicator includes a float that closes an electrical circuit, turning on a red warning light if the fluid drops below a safe level. *General Metal Products Corp., Wilmington, Ohio.*

A spare headlamp doubles as a trouble light in a highway safety-light kit produced by Westinghouse. A long cord plugs into the lighter socket and a special clamp supports the lamp. The kit also includes a reflecting caution sign for night use.

New locks that attach to the drip rail above the doors reduce the chances that children may tumble out while a car is in motion. Safety latch (far right) has a lip that blocks the door until a lever on top—beyond reach of childish hands—depresses the lip out of line with the door. As its name suggests, the Twistlok (right) includes a twisting member that moves into the line of the opening door. An adult must use both hands to work stops and arm to open door. *Spencer Specialties (safety latch) Los Angeles; Sleetex Co. (Twistlok), 404 Fourth Ave., NYC.*



A reflecting marker mounted on the edge of the driver's door will warn motorists behind to give you clearance if you sometimes indulge in the bad practice of opening the door in traffic. Two metal prongs slip under panel, holding Exilite. *Detroit Grille Mfg. Co., 258 E. Vernor, Detroit.*



A steel brake drum with copper fins to dissipate heat is said to increase braking safety. Available for trucks and buses, it may eventually be offered for cars. A band of copper is welded to the steel drum. Heat of brake friction is carried away by copper. *Copperweld Steel Co., Glassport, Pa.*

Gus Meets a Deadline

Shooting the mayor—even with a news camera—was a little out of Gus's line. No wonder there were unexpected developments.

By Martin Bunn

GUS stopped at the *Times-Chronicle* office on his way home one bright, cold Saturday afternoon—his paper hadn't been delivered for several days. Zelda Haworth, society columnist, was noisily pounding a typewriter, and Gus stood for a long moment before he caught her eye.

"Hello, Zelda. Anybody around to hear a small complaint?"

Just as she opened her mouth to speak, Will Gagan, reporter and photographer for the *Times-Chronicle*, came hurrying through the back door from the print shop.

"No, no, no," Gagan whispered as Gus took aim. "Get something dignified!"

"Just the guy I want to see," Will said. "Come out to the alley."

"Sure. What's back there, a little game in the old shed?"

"No," Gagan almost whispered. "You know me better than that!"

Gus grinned and followed Will. It was true. He did know him better than that.

Will Gagan, who comprised a fourth of the staff, was a quiet man. If a newsman was expected to cut a dashing figure, Gagan would have been a disappointment. He didn't drink, gamble, strangle telephones or shout "gimme the city desk" out of the side of his mouth.

"It's my car. I have to cover the groundbreaking for the new munitions plant outside of town this afternoon. Big thing, mayor and Army brass. I don't trust the old bus to get me there, and if it did, there's the matter of getting back in time to get the story and pictures under the deadline. It's okay as long as the engine is turning over fast. Slow down and it dies. I can't go speeding around on this icy pavement. As a matter of fact, the only way I can drive at a slow, safe speed in this slush and not stall, is to slip the clutch slightly and let the engine race. I know the clutch will take only so much of that treatment . . ."

"Now look, Will. I just left the garage. I've had a busy week and I'm taking the rest of the day off. Can't you borrow a car?"

"Nobody else in the shop has one. Even the delivery truck is out. Of course, I could get another mechanic . . ." Gagan made a long face and waited.

Gus Makes a Try

"Okay. Okay. Give me the key and I'll see if I can start her."

"No, not that way. That battery is too weak from me standing on the starter so much. I'll crank it by hand while you work the gas."

Gus opened the hood and worked the throttle while Gagan turned the crank. The engine sputtered and died. He tried again, hard.

"Ow!" Gagan stepped back, wincing and holding his shoulder.

"What happened?"

"I think . . . I pulled a muscle."

"I might have known. You newspaper boys get too soft sitting behind a desk! Why don't you run over to Doc Tandy while I work on this?"

"There isn't time. It'll be okay, but you'll have to crank."

Engine Acts as if It Needs Tuning

Gus locked the throttle at a point which would give the engine plenty of gas. A few turns of the crank had the engine running. It wasn't as smooth as it should be, but it acted like tuning was all that it needed.

"Slow it down, Gus, and watch what happens."

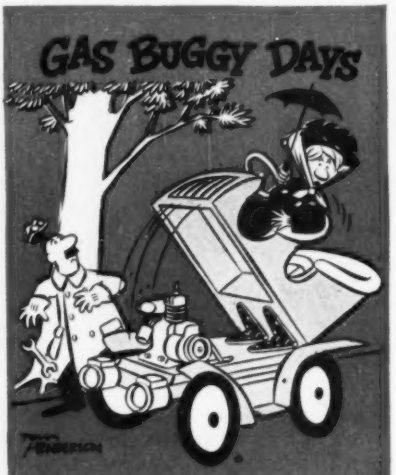
Gus closed the throttle and waited. The engine ran for a while, hesitated, then died. He puzzled over it for a moment.

"Got some tools?"

"A few, here in the trunk compartment."

Gus found what he wanted, removed a plug, and examined the electrode and its inside surfaces. It was wet and dark, gas-fouled.

Gus went around to check the carburetor. He saw then what he hadn't noticed before. The choke arm lever was bent, not much, but enough to shorten the linkage and hold the choke open a fraction. It wasn't flooding the carburetor, but it provided a much richer mixture than was needed.



In the Model car, circa 1905, the designer thought of everything. The engine was situated under the seat, but it was a cinch to get at it for repairs. You simply lifted up the body, which was conveniently hinged at the back.

He straightened it out with pliers and cranked the engine. It started easier this time.

"I think that's all it was." He slowed it down. "See? Even idles now. Let's go for a ride and test it. It'll run the battery up, too."

"We're getting short on time. Less than an hour until the ceremony."

"We'll make it. We can head out in that direction. You can't drive with that shoulder, anyway."

Gagan agreed, and they drove out of the alley. Gus began racing the engine a little to clean out the fouled plugs.

Before long, as they got out into the country, the traveling became more difficult. The road was covered with icy slush.

Gus had gradually slowed the engine, and now began to let it lug. It rumbled huskily for a quarter of a mile. The car wouldn't run that slowly before. But just as he was congratulating himself, the engine died. He pulled to the side of the road.

"Now we *are* in a spot," Gagan moaned. "Can't you do something?"

"Well, we know it isn't your carburetor mixture any more. Now it acts like your engine isn't getting gas. Maybe you need a new fuel pump."

"That's a new one. Look, I'll give you the whole story. The trouble started yesterday when I drove to Long Island to pinch-hit for the boss at an editors' convention. I took it to a garage, and the mechanic put a new pump in. Ran fine for six blocks! During my second visit, he blew the fuel line out. And it ran until I hit some traffic." Gagan lit a cigarette. "After being very late to the convention, I found, like I said before, that by slipping the clutch just enough to race the engine and still creep along, the thing wouldn't stall on me. The boss is up a tree about my being late yesterday—it wouldn't help to repeat that performance today!"

"Don't give up yet." Gus stepped out of the car and went to work.

The fuel pump and carburetor were okay. That much had been established. A quick look showed that the filter unit was clean. Next suspect was the copper fuel line. Gus disconnected it at both ends, at the tank and at the fuel pump. He turned to Gagan.

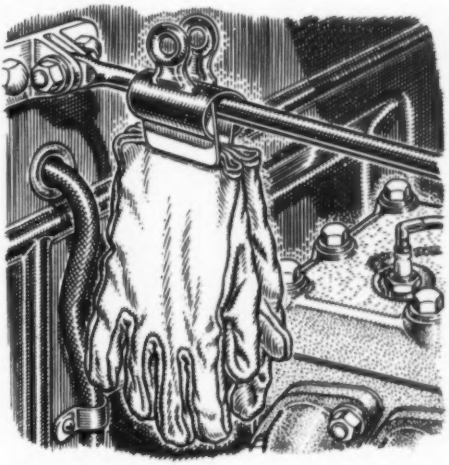
"Hold your finger over that end, while I put pressure on the line."

Gus wiped off the other end and blew

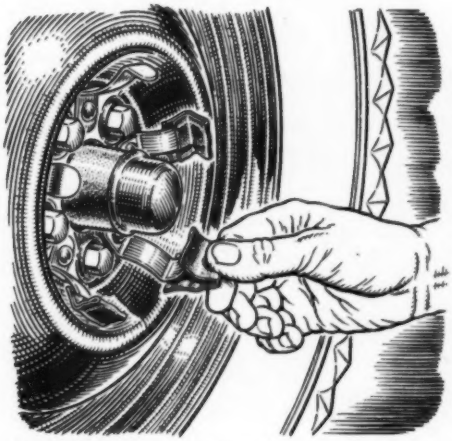
[*Continued on page 252*]

Hints FROM THE MODEL GARAGE

Back up your plates with composition board or exterior-grade plywood to keep the thin metal from becoming banged up in parking scrapes. Run fasteners through plate and board on both edges; use two bottom screws to mount the assembly to the car.



A trucker's gloves will dry as he drives if clipped under the hood like this. A big paper clip astride the radiator support rod is one way to hold them near the hot exhaust manifold. With two pairs along, he can have one pair drying at all times.

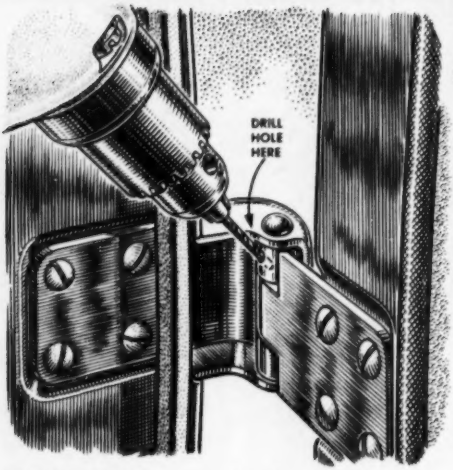


Squeaks may come from the wheels of even a new car. If you have trouble tracking down an elusive running-gear noise, don't neglect the hub caps. In one case, removing the caps and applying a strip of tape on each clip silenced a mysterious chirp.

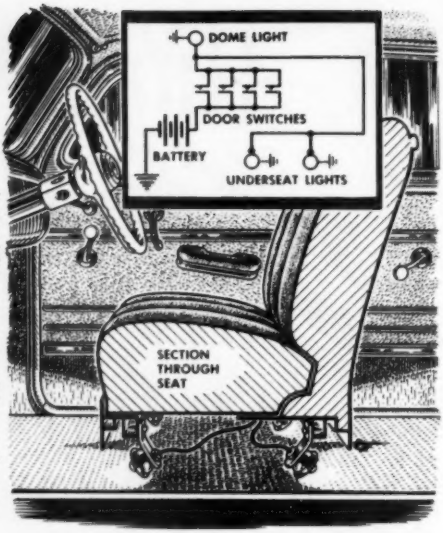
A bumping board placed inside the garrage at the height of the car-door handles will keep the door from being sprung if the car rolls back with the door open. An 8" board placed at handle level will give the driver time for second guesses.

Please turn the page for more auto hints.

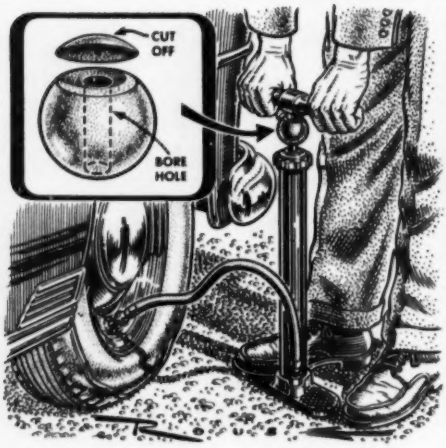
MORE Hints from the Model Garage



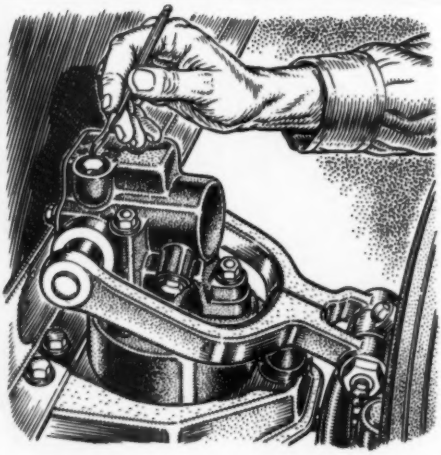
External hinges on the doors of old cars often develop a rusty-gate wheeze, and oil squirted on the hinges may do no good. As a remedy, try drilling a small slanting hole near the top of the hinge, going just to the hinge pin. Fill the hole with penetrating oil and let it work down the length of the pin.



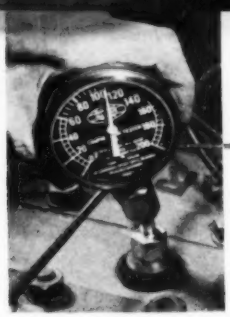
Lights on the floor are a big convenience in a car and easy to install. Get a pair of truck marker lamps, remove the red glass and bolt the lamps under the front seat so one will shine to the front and one to the rear. Wire the lamps as shown so that the door switches will turn them on along with the dome light.



A small rubber ball can be made into a shock absorber for a hand pump. Cut a slice off the ball and drill a hole so that the ball is a snug fit on the pump rod. If the rod bottoms before the ball takes up the shock, shorten the rod slightly.



Clean dirt from around the filler plug of this type of front shock absorber before attempting to remove the plug. Unless you do, there's a good chance the socket won't go all the way down, you'll round off the plug corners and never get the plug out.



What a Compression Gauge Can Tell You

Cylinder pressures developed in a car engine offer clues to trouble if you can read them.

Conclusions that can be drawn from the chart (below) of a compression test which the writer made on his car:

No. 7 cylinder definitely was losing pressure. The oil seal in the second part of test increased the pressure only slightly, indicating that trouble is mostly in valves or perhaps the gasket.

No. 8 seems to have a valve or gasket loss, although not great. No. 1 cylinder, which made a good recovery when oil was introduced, apparently is losing pressure past the piston.

Gauge variation or carbon build-up may explain the fact that the average dry compression is higher than the 120 pounds specified for this engine as normal. Wet test was not made on cylinders that seemed okay on the first test.

CONSIDERING how little it costs and what it can tell you, a compression gauge is one of the best tools that a car owner can have. In skilled hands, it will point to such troublemakers as:

- Sticking valves or worn valve seats.
- Worn or sticking piston rings.
- Scored cylinder walls or worn pistons.
- A blown cylinder-head gasket or loose head bolts.
- Sizable carbon deposits in the combustion chambers or on the tops of the pistons.

The object of a compression test is to measure the pressure developed in each cylinder by the movement of the piston. The gauge gives readings in pounds per square inch. Using one may save you money by revealing a fault while it still can be corrected easily.

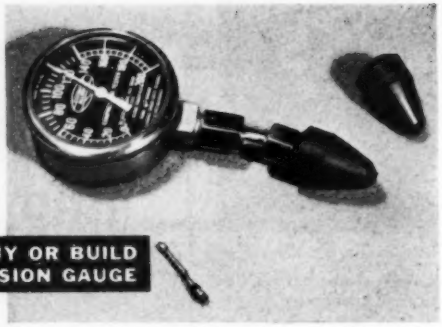
To run a test, first warm up the engine oil completely, perhaps by taking the car for a drive. Be sure, too, that the battery is definitely well charged.

Blow all dirt and dust from around the spark plugs and remove the plugs and their gaskets.

Disconnect the high-tension cable that runs from the coil to the center terminal of the distributor cap. Usually the throttle and choke valve should be open, although directions with some commercial gauges may say to keep the throttle closed.

Connect the compression gauge to the spark-plug hole of the first cylinder. If the gauge has a rubber-cone tip, simply press the cone firmly and squarely into the hole.

Operate the car starter, turning the engine over several times until no further increase in gauge pressure is seen. If your starter switch is solenoid-operated and you don't have a remote-control



YOU CAN BUY OR BUILD A COMPRESSION GAUGE

Homemade gauge makes use of an air gauge with a maximum reading of 200 pounds. Hold it this way to take a compression reading, thrusting the rubber nozzle into the spark-plug hole. Photo sequence below shows how it's made.

Commercial gauge like this is available from mail-order or auto-supply houses for around $5. Valve in stem keeps needle at maximum reading until released. Long-stem gauges are made for engines with hard-to-reach plug holes.

1 Parts used include the air gauge, which happened to be panel-mounting type with a threaded pipe connection at rear rather than at side; a ⅜" pipe tee capped at one end (an elbow would have done), a rubber stopper, a short ⅜" pipe nipple, a washer, and a valve assembly taken from an inner tube. Grooved portion of valve body should be filed down as necessary to fit inside the pipe nipple.

jumper, get someone to press the button on your signal.

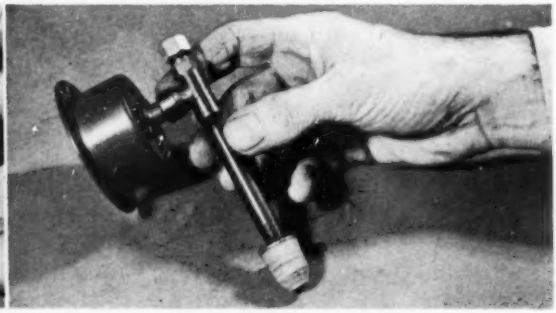
Record the readings on a sheet of paper as you progress. Notice how much pressure is indicated for the *first* compression stroke of the piston. Jot down the maximum pressure developed by the cylinder—the reading beyond which the gauge needle will not move.

Release the pressure in the gauge by depressing the valve stem and test all cylinders the same way, writing down the maximum reading for each.

What the figures mean. Maximum cylinder pressure varies among different makes and models of cars. You can learn the normal cylinder pressure for your car from the manufacturer's specifications.

If the pressure in each cylinder is close to that recommended as normal, or if all

2 How it's assembled. Tin outside of valve body and inside of nipple near one end, insert valve body half its length and solder the two together. File down valve-body shoulder so washer can be pressed over it as above. Drill stopper lengthwise to turn up on valve.



3 Completed gauge. Notice how bottom of stopper has been shaped to fit into spark-plug hole. This can be done by filing. For a gauge with connection at side, run nipple straight without tee or elbow. Some engines require a longer stem, perhaps offset at angle.

cylinder readings are about the same (in case you don't know the recommended pressure), everything is probably fine.

If the pressure is definitely lower or higher than the recommended pressure, but there still is no variation of more than a few pounds among the cylinders, you still have no particular cause for worry.

But if one or more cylinders read decidedly low by comparison with other cylinders, all is not well. Suppose that one cylinder shows up low in a test of an eight-cylinder engine. Add together the pressures for the other seven and divide the total by seven to get an average. Subtract the low figure from the average. If the difference is greater than 10, you can expect to find trouble.

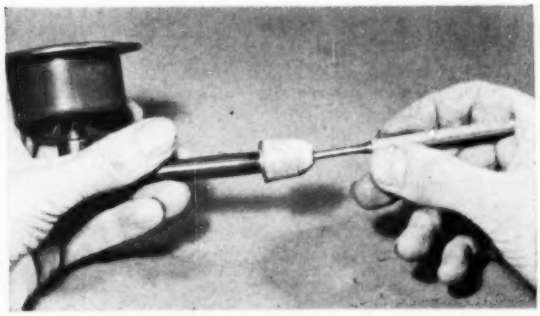
Now run a second test by squirting about a tablespoon of medium or heavy engine oil into the spark-plug holes of the cylinders which showed decidedly low pressures on the first test. Turn the engine over a few times to draw oil down around the pistons and act as a compression seal.

Using the gauge as you did before, take a pressure reading of each cylinder into which you squirted oil.

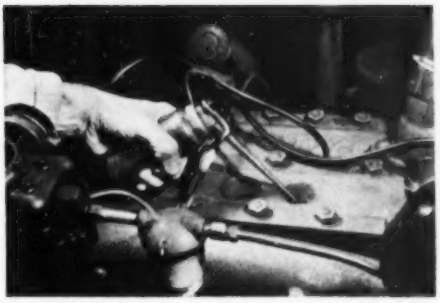
Interpreting the figures. Now by studying and comparing the pressure figures, you can learn a lot about the engine.

If on the dry test, the pressure in a cylinder went up only a piddling 15 pounds or so on the first piston stroke and then, on succeeding strokes, built up slowly to the maximum, you can suspect that the valves were sticking or the valve seats are in poor condition.

Adding oil to a cylinder nearly always



4 **Slender tool** depresses valve core to release air after gauge has been used. Test the gauge for air leaks on a service-station air hose. If gauge is to be used to measure compression in comparison with specified pressure, check it against a standard gauge.



Squirting oil into cylinder provides seal for second set of compression readings. Crank engine a few times to distribute oil.

causes *some* pressure increase. If the pressure in a low cylinder jumps close to the average on the wet test, you know that compression was being chiefly lost past the piston. This may be the result of worn rings, gummed rings sticking in their grooves, a scored cylinder wall or a worn piston. Sometimes the use of a solvent will restore compression by freeing stuck rings.

If a low-reading cylinder comes up only slightly when oil is added, the trouble probably lies in the valves or the head gasket. Adjusting tappet clearance or tightening the head bolts may cure the trouble. Or a valve-grinding job may be required.

If the oil causes a marked increase in pressure but the reading still is decidedly below average, some of the leakage is past the piston, some through the valves or around the gasket.

Two side-by-side cylinders showing low pressures suggest that a gasket leak is located between them. Sometimes tightening the head bolts will bring the pressure up.

Higher pressures than those specified for an engine may indicate that large deposits of carbon in the combustion chambers or on the piston tops are reducing combustion-chamber volume. Too much crankcase oil working into cylinders also can cause a pressure increase. Adding more oil through the plug holes, therefore, could not be expected to increase the pressure. If the engine is pinging, try retarding the spark or using a gasoline of higher octane rating.

Compression tests depend on a good wear-in of the piston rings. So they may not be accurate on a new engine, one recently rebuilt or one having new rings.—*Walter E. Burton, Akron.*

Next Month: What a timing light can tell you about your car's ignition.

How to Panel with Plywood

Natural-wood walls, once a rich man's luxury and a carpenter's headache, can now be put up in a few hours with only a hammer and saw.

By Darrell Huff

IF YOU have a good wall you want to show off, or a bad one you want to cover up, plywood panels may be the answer. The big, handsome sheets go right up over an old wall or ceiling and need only nails, a hammer and enough know-how to get the two together at the right time and place.

They'll hide cracked or falling plaster by simply putting it all behind them, give a fast facelift to dingy paint or wallpaper, or add a striking decorative touch to a dull eyesore.

Once up, they take little or no maintenance and eliminate the endless patching, painting and papering that other walls require. Reasonably cared for, they'll outlast you.

They go a long way, so you can get a lot of effect for a relatively little money. A few sheets around a fireplace may be all you need to liven up an otherwise plain living room. A few more will convert a dreary basement into a warm, pleasant playroom, an unused attic into a den or extra bedroom. A paneled ceiling will make people look up instead of downcast.

Choosing a plywood. Once available in only a few types, plywood panels can now be had in nearly all the woods of the forest—plus a few special treatments that never grew anywhere.

The most common and least costly are the rotary-cut softwoods like Douglas fir, knotty pine, cedar and redwood. They have irregular, rather prominent grain and run around 30 cents a

Wood grain stands out in new ¼" textured plywood called Sea Swirl. Here 4' by 8' sheets were ripped into 24" widths, separated by strips of plain wood 1" wide.

Precut plywood planks are 16¾″ wide to match stud spacing and up to 8′ long to fill full wall height. Called Plankweld, they come in birch, oak, knotty pine and mahogany. Panels can be put right up over old walls, are held on by invisible metal clips that are nailed to studs. Grooved edges interlock for strength, make slight lap joint.

square foot for the ¼″ thickness. They also come with vertical grain that is much quieter.

Pocketbook permitting, you can go into the more expensive—two or three times more—hardwoods. These are veneered plywoods that can be had in a number of varieties from birch, oak, walnut and mahogany to the more exotic korina, avodire and rosewood.

There are several textured plywoods that add a striking touch to a plain surface. Striated Weldtex has fine grooves cut in the face. One of the newest specialties is WedgeWood, a wire-brushed hemlock that makes the grain stand out in relief. Another is a fir plywood called Sea Swirl that has the soft growth removed to give the appearance of a split shake. Then there's Plyweave, which has a pattern of broken parallel lines imposed on either fir or redwood.

All of the textured types hide nailheads well and minimize occasional misfits between panels. You can also get a plastic-paper-faced plywood made especially for painting.

Precuts save work. One of the newer kinks in plywood are the narrow planklike panels called Plankweld. These are 16¾″ wide to match the usual spacing of wall studs and come prefinished to save work. Costing around 55 cents a square foot, they are more expensive than the standard 4′ by 8′ panels, but are simpler to use since they eliminate much of the cutting, fitting and bruting around of the big sheets.

Precut squares of 5/16″ striated Weldtex are another work saver. These come in 12″, 16″ and 24″ sizes and are especially effective if put up with the direction of the grooves alternated, producing a checkerboard effect. Many of the regular plywoods are also available in nonstandard sizes like 3′ by 4′, 4′ by 4′.5′ by 7′ and 3′ by 6′.

Using the big sheets. These, on the whole, are the most economical because of their size and cover a lot of area fast for the same reason.

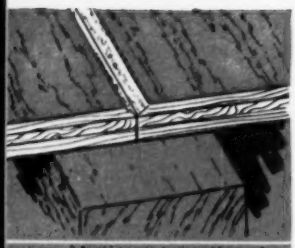
The common size is 4′ by 8′, but for walls

Big sheets are made to look like small, individual planks by scoring horizontal lines into face of panels. Table is plywood, too, with glass top to protect it.

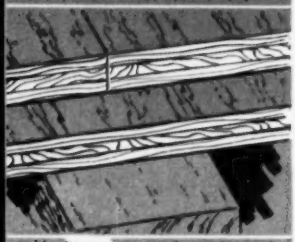
Unusual arrangements like this not only provide interesting effects but are a fine way to save waste by permitting use of odd-size scraps normally discarded.

Looking at the ceiling is easy with this checkerboard arrangement of 5/16″ Weldtex squares. Squares come in 12″, 16″ and 24″ sizes, cost around 30 cents a square foot.

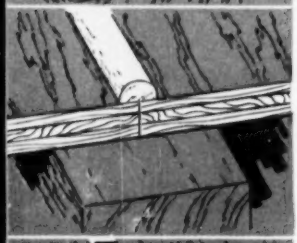
Raised-panel effect is obtained by first nailing up narrow backing strips and then bridging them with big panels nailed on top. Space panels about 1″ apart.



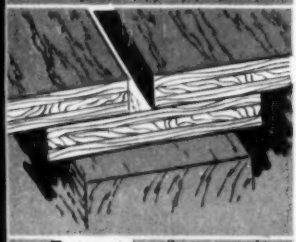
V joint, one of most common types, is made by beveling edges of meeting panels. Use block plane or have mill do this for you. On hardwood plywoods, use shallow V to avoid exposing different-colored wood under veneer. Nailing into bevel will help hide nailheads.



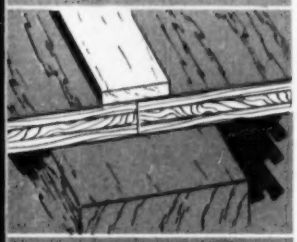
Butt joint looks simple, is actually hardest to make because meeting edges must fit perfectly. Use it only on most costly veneered plywood where other joints might be objectionable.



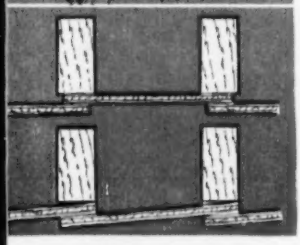
Half-round molding is cheap, easy to put on and hides nailheads and an occasional sloppy fit between panels. Fine for light-colored softwoods; not preferable with darker hardwoods.



Gap joint, one of newest and most modern, leaves space between panel edges. Strip of matching plywood is nailed on first to back up gap. Gap should equal wood's thickness.



Batten joint is similar to half-round but uses thin wood strips to cover seams. It has added advantage that strips can usually be cut from solid stock to match dark veneers.



Lap joints accentuate seams instead of concealing them. Recessing every other board (top left) creates raised-panel effect, is modern, formal. Conventional shingle-type lap (bottom left) gives rugged, rustic appearance. Both types of joints cut edge nailing in half.

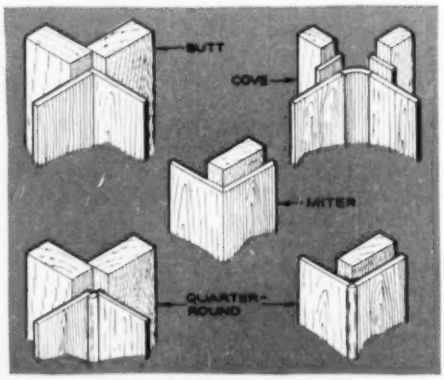
higher than 8′ you can get some panels in 10′ lengths. These must be trimmed, however, and may result in considerable waste. You can save money by hiding small gaps behind baseboards and moldings, as shown in one of the sketches.

For paneling over existing walls, the ¼″ plywood—the thinnest and cheapest—is sufficient (in a few types, 5/16″ is the thinnest). If you want to combine doors, cabinets and other built-ins with your paneling, you'll find there are ¾″ sheets in woods to match most of the ¼″ types. These are expensive, though, and for big jobs you may find it more economical to build forms first of cheap ½″ structural-grade plywood and then cover them with a ¼″ facing like a veneer.

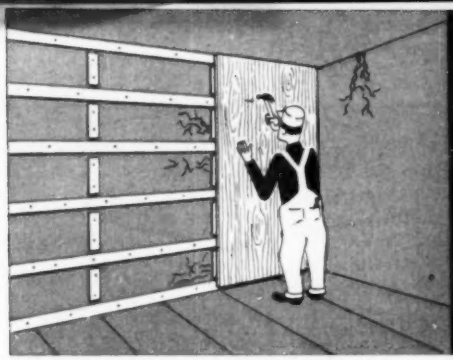
Over bare studs, the ¼″ sheets alone are too thin and must be backed up with ½″ structural plywood nailed on first.

Putting it up. Where existing walls are in good condition, you can put the panels right up over the old surface and nail through it into the studs. On plaster walls, you can locate the studs by tapping (they give a solid sound, the spaces in between a hollow one) and by test pokings with a nail or small drill. On dry walls (plasterboard and wallboard), you can usually find the studs by simply prying off the baseboard molding and noting the points where the panels have been nailed on.

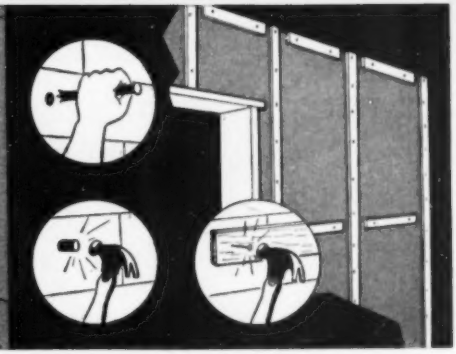
On walls that are badly out of line or where plaster is cracked, you may have to put up a light framework of furring strips, as shown, to cover the irregularities.



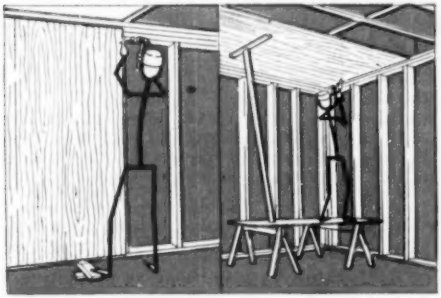
Corner joints can be as plain or fancy as you like. Easiest—and quite acceptable—is simple butt joint, used most on internal corners but also fine for external ones if slightly rounded to avoid splinters. Quarter-round, cove and miter are also common but trickier to fit.



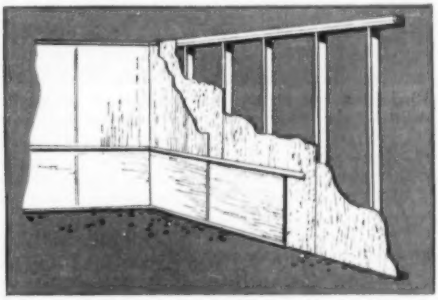
Framework of 1″ by 2″ furring strips provides smooth backing for paneling over walls that are badly cracked or out of line. They must also be used where edges of panels will not fall on studs. Nail horizontal strips into studs, starting at ceiling and floor and spacing others every 16″ in between. Then add vertical filler strips wherever edges of panels come.



On masonry walls, furring strips are used to give nailing surface for panels. Fasten strips to concrete with cut steel nails, about 12″ apart. If concrete is too hard or nails won't hold, use method shown above. Drill hole first with carbide-tip drill, pound in oversize wood peg, then nail furring strip into peg. Or you can cement patented furring-strip fasteners on the masonry.



Foot pry (left) jams panels tight against ceiling, frees hands for hammering. T support (right), made of stick with crossarm at top, provides extra hand to help hold up big sheets.



On new walls, thin ¼″ outer plywood is backed by ½″ structural plywood nailed to studs first. Backing adds strength, gives nailing surface for panel edges that don't fall on studs.

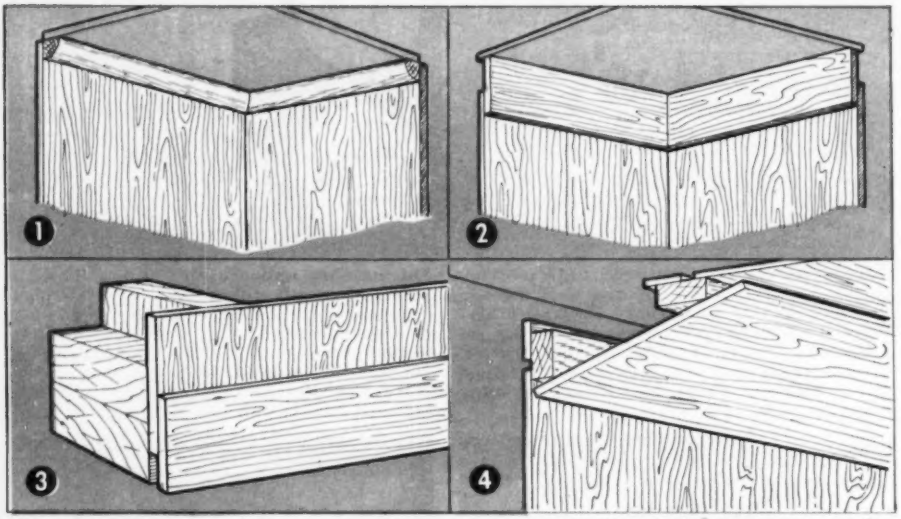
Furring strips are a must wherever the panels are less than full ceiling height, as in a pattern of small squares, since the studs alone would provide no cross pieces to hold the horizontal joints. A sketch shows how the same method is used on masonry walls.

Keeping out moisture. Over exterior walls, you'll have to take some precautions against dampness that deteriorates the wood.

On plaster or masonry that is dry, it is enough to seal the back of the plywood with a prime coat of paint. Where there is evidence of moisture, you should seal the wall first with white waterproof cement paint. Or you can tack asphalt-saturated paper to the furring strips, giving it a 2″ lap. Also back-prime the panels first.

If the plywood you want to use comes in

Paneled ceiling (left) is strong, handsome, easy to put up. Here 4′ by 8′ sheets of ¼″ WedgeWood were cut in half to ease handling and create checkerboard of 4′ squares. Light sanding of edges (right) makes attractive V joint. Nail panels to rafters, either directly, as in new construction, or through existing surface on old ceilings. Rafters are usually 16″ apart.



Finishing off at top and bottom of panels is most easily done with quarter-round molding (1). Large gaps can be covered with strips of the same plywood, ripped from leftover scraps, which also permit exact matching where molding may not (2 and 3). Cornice-type ceiling molding (4) is easy to build, hides a lot of bare area, can be modified later to take fluorescent lighting. Occasionally no molding is used at ceiling, but panels must fit perfectly.

a waterproof exterior grade, you can head off moisture by simply using that.

Hiding the joints. It is impossible to conceal a joint completely since even the most carefully butted panels will have a hairline seam and may open up to show a larger crack later on. Because of this, most people prefer an obvious joint to a half-hidden seam.

There are two ways you can do this. You can cover the joint with narrow wood strips or deliberately expose them by overlapping the panels, beveling their edges, or leaving a slight gap between them.

For the fancier hardwoods, there are special veneer-faced aluminum moldings for finishing off joints and edges. You simply nail the moldings in place and fit the panels.

PLYWOOD PANELING

These are the grades of interior Douglas fir plywood. "A" grade veneer is the finest quality. "B" grade is smooth and paintable but may have small knots and slight defects. "C" has tight knots, small knotholes. "D" permits larger knotholes, pitch-pockets, splits, patches. Grade names are from Douglas Fir Plywood Association.

Name	*Face*	*Back*	*Uses*
Interior A-A	A	A	Anywhere both sides will show, especially where natural finishes are used: cabinet doors, built-ins, furniture.
Interior A-B	A	B	More economical alternate for A-A; just about as good, particularly if one side is painted or doesn't show much.
Plypanel	A	D	Standard for paneling where only one side is to show, as on walls and ceilings.
Plybase	B	D	Mostly used as backing material for paneling, but also makes a good low-cost wall or ceiling.
Plyscord	C	D	Unsanded. Used mainly as backing or sheathing.

FOR YOUR *POPULAR SCIENCE MONTHLY* INFORMATION FILE

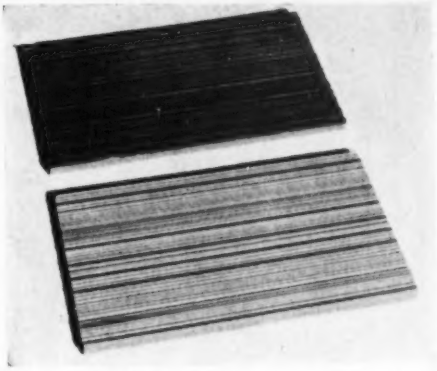
Arranging the panels. There are several tricks for laying out panels to save cutting and provide a pleasing pattern of joints. To avoid intricate fitting around doors and windows, full panels are usually started on either side of the openings and the smaller spaces filled in between. On plain walls, it's best to center the pattern so that any fractional panels will be the same at each end.

You can keep all joints vertical—the simplest arrangement—or use the tops and bottoms of windows as guide lines for horizontal joints.

Nailing plywood. For ¼" paneling, either 4-penny finishing nails or ¾" No. 19 brads will do, the latter being a little lighter but neater-looking. Use 6-penny finishing nails on the ⅜" and ½" thicknesses and 8-penny on the ¾". Where you must nail into studs through an existing plaster or wallboard surface, be sure to use nails that are at least two sizes larger in each case. Nails should be spaced every 6" on the edges of a panel and every 12" in between.

Finishing plywood is the other big half of the job, but it needn't be hard if you know the tricks. In a coming issue PSM will tell you about the types of finishes and how to use them.

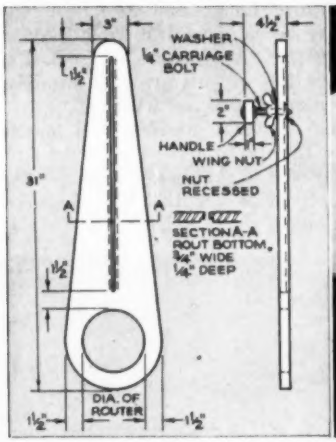
Plywood Finished in Two Colors

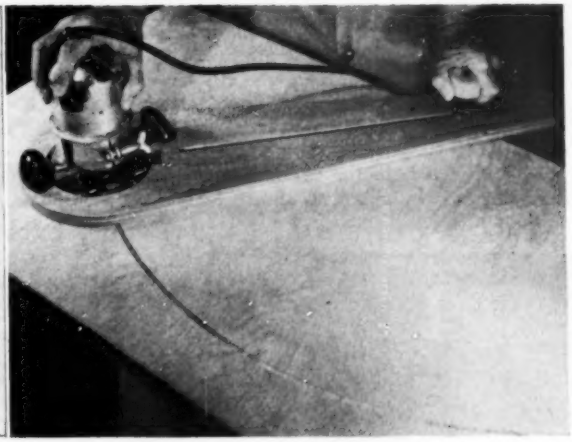


LOOK at these panels of striated Weldtex plywood from one angle and you see one color. Look at them from the opposite angle and you see another color.

Secret: The first color is sprayed on at an angle of 30° to the wood from one side. When this is dry, the second color is sprayed on at the same angle from the other side. Thus the ridges in the wood are one color on one side, another on the other. Looking at the panels straight ahead gives a combination of the two colors.

Jig Holds Portable Router for Making Circular Cuts

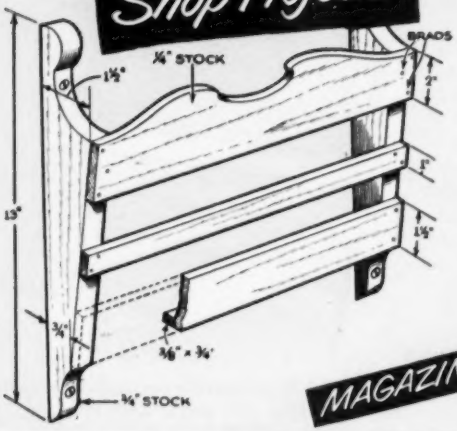




THIS routing jig adapted to your portable router will enable you to cut perfect circles of any radius within the range of the slot. It is just the thing for cutting grooves in a round table top for inlaying. By making several passes with the router, adjusting the depth of cut each time, you can cut a perfect disk out of a panel.

The jig is made from ¾" plywood. The slot is cut down the center with the router itself before cutting the jig to shape. A hardwood knob is mounted on a pointed bolt that can be slid along the slot and locked with a wing nut to adjust the radius. Lacking a lathe, the bolt point can be filed.—*Walter Haase, Hartford, Conn.*

One Evening Shop Projects



MAGAZINE RACK

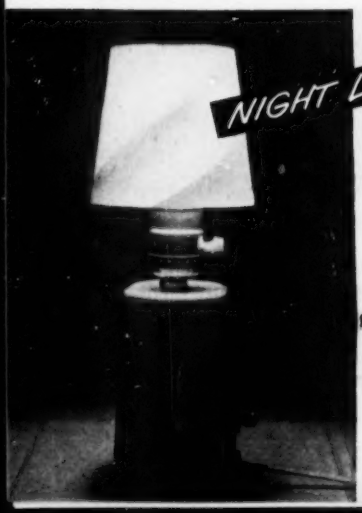
The back of a door is a handy but out-of-the-way spot to keep magazines. This rack can be made in multiples to cover an entire door. Heights of the side pieces should be modified to suit different-sized magazines. Quickest way to form the curved sections is to use a bandsaw or jigsaw to cut stacked wood. Assemble with glue and brads and finish to match the door.—*Hi Sibley, Nuevo, Calif.*

Bright light for reading, soft light for sleeping, colors to match the bedroom—all yours for an evening's work without one lick of a paintbrush. The two-way lamp below is a quick-and-easy assembly job.

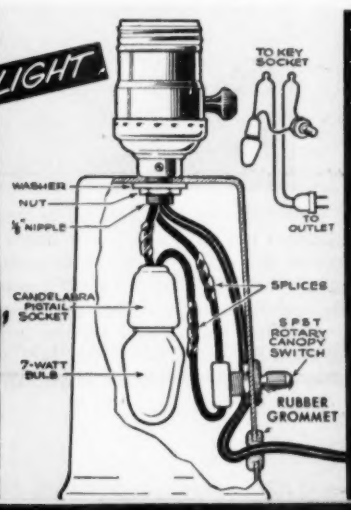
A colored plastic tumbler 5" high serves as a base. It houses a seven-watt candelabra bulb in a pigtail (Christmas-tree) type of socket. This lamp shines through the plastic, giving enough light for reading a clock or finding your way about, as shown in photo at right below.

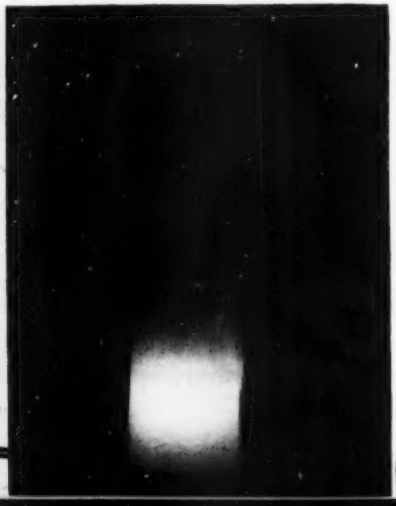
Drill holes for the cord, upper socket mount and switch with care to avoid cracking the plastic. Large drills are prone to grab; it may be safer to drill ¼" holes and file them to size. A standard key socket is mounted on top of the inverted tumbler with a ⅜" pipe nipple and lock nut.

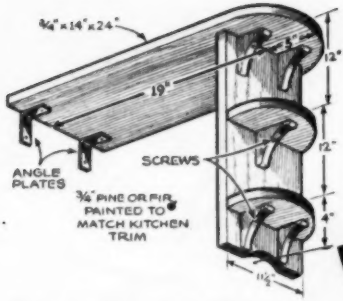
Solder all splices if possible, and bunch the wires with tape to make the candelabra socket hang free in the center. The plastic shade simply clips on the bulb.—*Arthur Trauffer, Council Bluffs, Iowa.*



NIGHT LIGHT



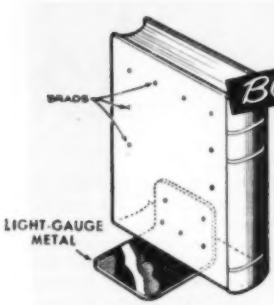




SNACK TABLE

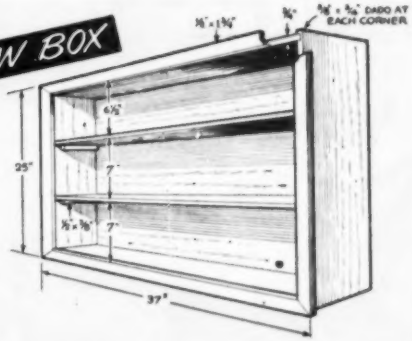
For after-school snacks or a hurry-up breakfast for Dad or Junior, this table in the kitchen fills the bill. Construction is simple. It can be made of ¾" plywood or of glued-up flat stock. Fasten it to a kitchen wall or cabinet side with angle brackets. The waste left from sawing the rounded corners was utilized to make the supporting brackets for the shelves.—*George Reiser Jr., NYC.*

BOOK ENDS



Two discarded books and a pair of concealed brackets will make invisible book ends. Bend back the covers of each book and drive brads through the pages to form a solid mass. Attach the brackets, made of any light-gauge metal, by driving more brads into the pages through holes drilled in the metal. Glue the covers back in place and your novel book ends will mystify your friends.—*Frank Shore, NYC.*

SHADOW BOX

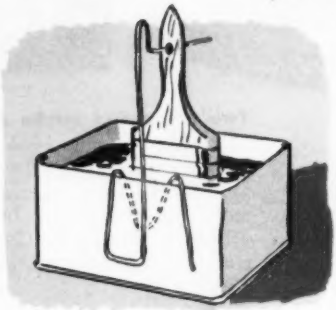


Models, ceramic figures or other hobby collections can be attractively displayed in a trim white shadow box. Cut and rabbet the parts and assemble with glue and brads. Finish with enamel and mount the box on a wall with picture hangers. For rooms finished in rustic style, use a scalloped frame—*Walter Haase, Hartford, Conn.*

KEEPING THE Home SHIPSHAPE

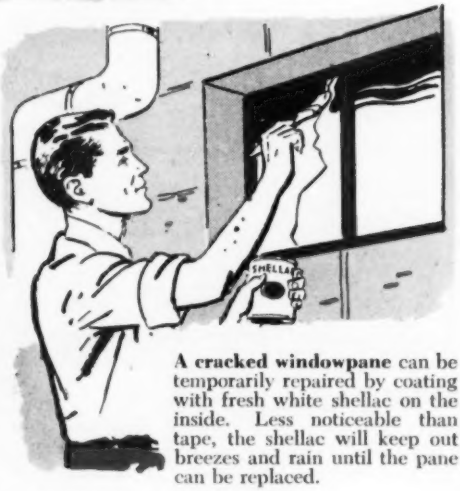
Suspender clips from worn-out braces sewed inside a child's coat sleeves will anchor his mittens and guard them against loss.

Clean clothespins for little laundry jobs between washdays can be kept handy in a fruit jar. Nail lid to clothes pole, then screw jar in place.



For hanging brushes in turpentine, a clip can be bent from a wire coat hanger. Drill a hole in each handle, locating the hole so that the bristles will clear bottom of can.

Rubbers and overshoes find a neat storage place in an old metal breadbox. Fancied up with a coat of flat black paint and a gold initial, it will be handsome enough to be parked conveniently near the front door.

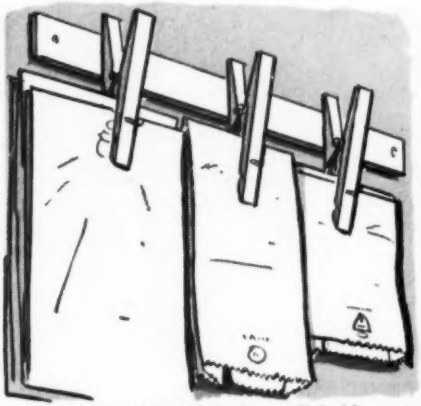


A cracked windowpane can be temporarily repaired by coating with fresh white shellac on the inside. Less noticeable than tape, the shellac will keep out breezes and rain until the pane can be replaced.

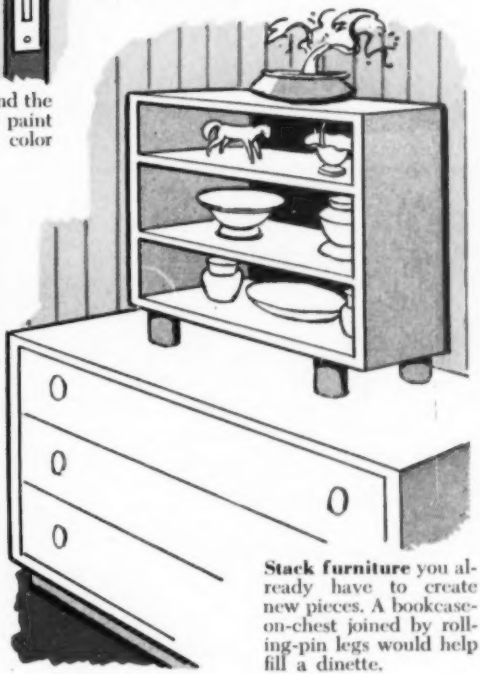
Save those little cans that hold concentrated fruit juice. They're just right for freezing icebox-cookie dough. At baking time, the bottom of can is cut out to push dough through for slicing.

A tool pouch cut from an old hot-water bottle is handy when working around the house or garden. Two slits allow it to be hung from the belt.

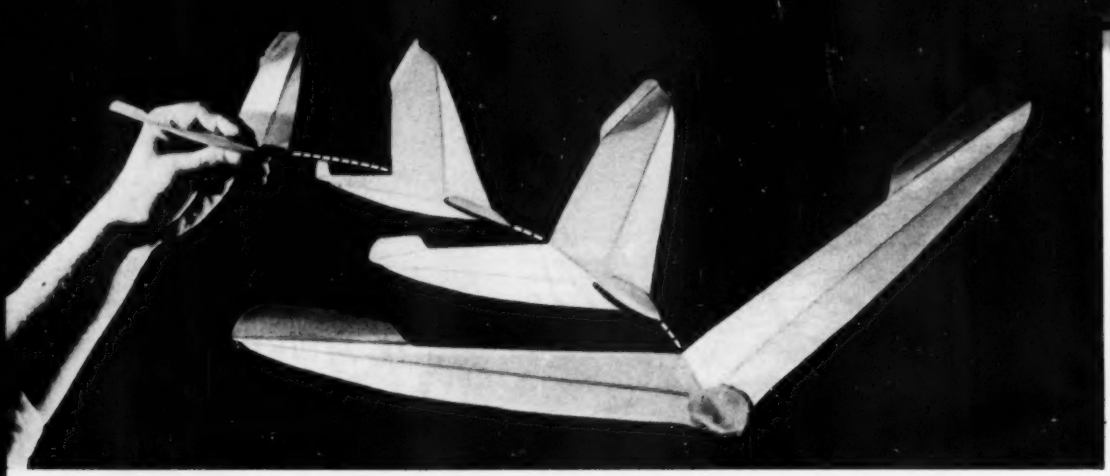
To foil fingerprints, try painting flowers around the doorknobs of light-colored doors. Use an oil paint that can be washed easily and choose a dark color that won't show smudges readily.



A kitchen clip board that will hold paper bags, bills and household memos is easily made by attaching a few spring-type clothespins to a piece of yardstick.



Stack furniture you already have to create new pieces. A bookcase-on-chest joined by rolling-pin legs would help fill a dinette.



Paper Flying Wing Gives Lessons in Flight

Study the slow-motion antics of this paper model that will float around your living room for five seconds or more.

THE easiest way to analyze motion is to study it in action. No strobe lights are needed to study the flight characteristics of this flying wing—its feather-like glide quickly shows the effect of small changes in shape.

The pattern on the opposite page is a basic one for flying-wing gliders, but exact size isn't important. One that I made from tissue paper had a wingspread of 3″ and an average gliding time of 7 seconds—a long flight indoors. To launch, hold high and release gently—don't throw.

There are three points to watch for in making these gliders: (1) Lay out the wing so that the grain of the paper runs across it from tip to tip. Drape the square of paper over a pencil, first one way and then the other. Whichever way it sags least shows the direction of the grain. (2) Cut both wings identically so the glider will balance. (3) Trim the nose weight so that the glider will neither stall nor dive.

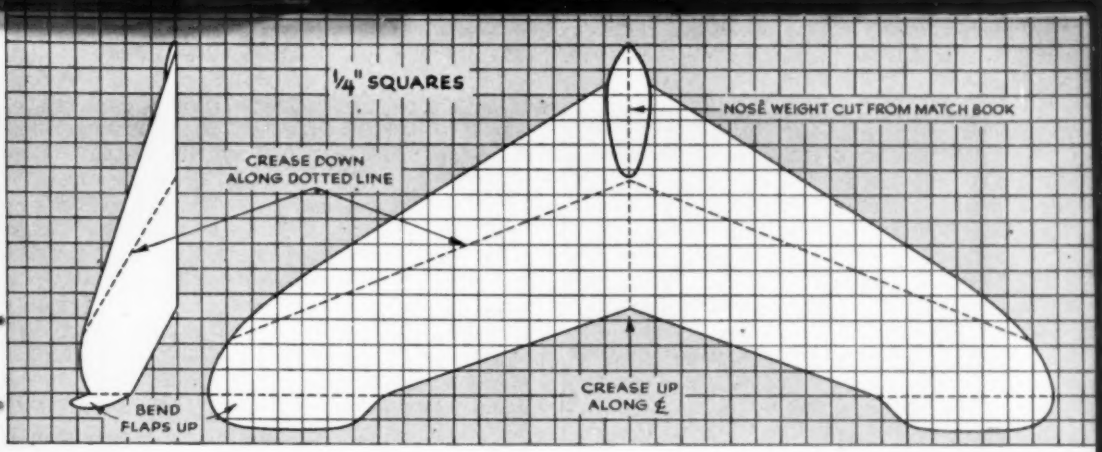
At right are more tips on cutting and folding your glider.—*Wallis Rigby, NYC.*

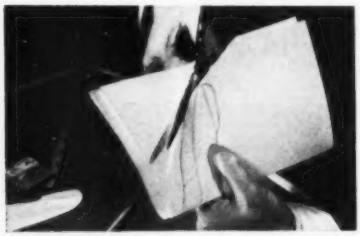
Chemical Treatment Kills Static Charges

STATIC electricity, an elusive imp that attracts dust and gives finger-tingling shocks, is at its worst these steam-heated months. It can easily be tamed, though, with any of the new static-grounding solutions that bleed off electrical charges before they can build up to a nuisance level.

The chemical solution I've used, which costs about 60 cents for a 4-oz. bottle, may be brushed, sprayed or wiped on, and it dries to an invisible film. Some other uses beside those at right include adding a dilute solution to the rinse water for nylon shirts or slips; spraying on such dust attractors as plastic radios or TV sets; and wiping on auto slip covers and door or window handles.—*Ken Murray, Colon, Mich.*

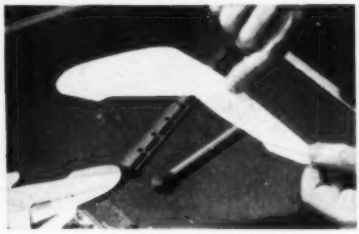
Unpleasant shock, such as that received when walking across a thick rug, is completely eliminated by spraying rug with alcohol-diluted antistatic solution. Floor wax, with three percent antistatic solution added, treats floors at regular waxing periods.





Cutting tissue glider is tricky. For clean cut, tissue should be folded into sheet of typing paper to back it up and to keep it from creeping away from the scissors.

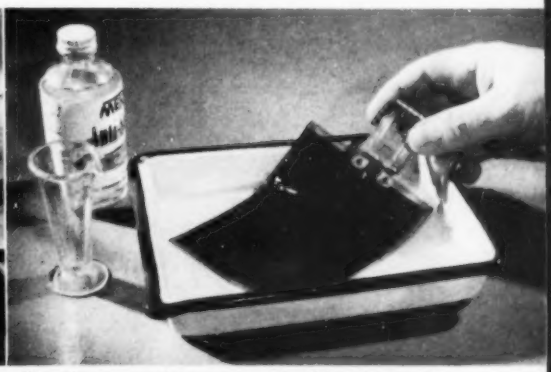
Two gliders at one cutting. Separate tissue cut out from paper. Though both are the same size, tissue glider will float, prolonging its flight, while paper glider will swoop across room.



Crease wings to form camber and make them more rigid. Bend flaps up in opposite direction. Fold accurately on guide lines. Careless folding can destroy inherent stability.

Nose weight, cut from match-book cover, is glued in place. If too light, a smaller weight of the same shape can be glued on top of it. Crease weight along its center.

Charged-up records will pull ashes out of tray just as they pull dust out of the air. Treated record at right has lost its attraction for dust, which means that it will last longer and play with less surface noise. All treated objects stay clean longer.



Dustfree negatives are produced by rinsing after processing with antistatic bath mixed as follows: 6 c.c. Kodak Photo-Flo, 10 c.c. antistatic solution, water to make 1 liter (filter before using). The negatives will dry quickly without requiring wiping.

Treasure Chest Stores Records

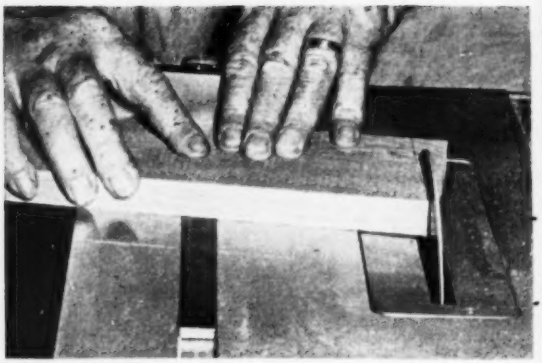
Dark contrasting oak and beaten brass make this authentic-looking pirate chest a real treasure in itself.

By Shep Shepherd

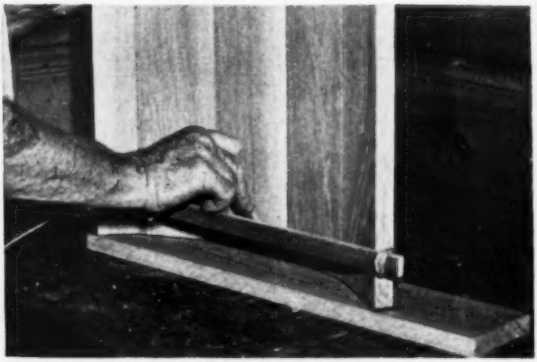
LONG JOHN SILVER would have given his other leg for a chest like this. You can have it the easy way—by making it in your workshop. While it's fine for storing phonograph albums, there are a lot of other uses for it in close-quarters living. Examples: holding the kids' toys, storing liquors, concealing a tank-type vacuum cleaner.

WHAT YOU WILL NEED

5 pieces 1" by 4" oak 25½" long.
2 pieces 1" by 2" oak 25½" long.
6 pieces 1" by 4" oak 24" long.
8 pieces 1" by 4" oak 18" long.
1 piece ½" plywood 12" by 22½".
18 feet thin brass 1½" wide.
100 roundhead rivets ¼" long.
Brass handles, hinges, hasp, chain.



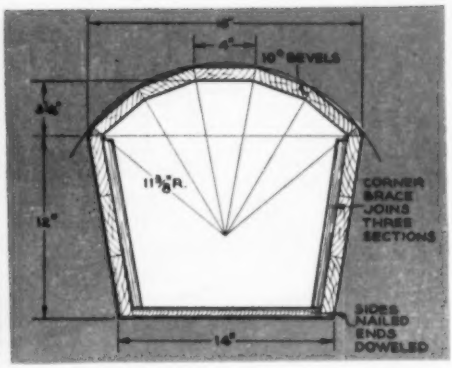
1 CHEST ENDS are cut and fitted first. Lower edge of bottom endpiece is 14" long; upper edge of top piece is 18" long. Miter head is set at 10° to trim ends.



4 LID PIECES are tied together with cord and braces and outline is drawn on lid end boards. After end boards are cut the segments are joined to them with glue and nails.

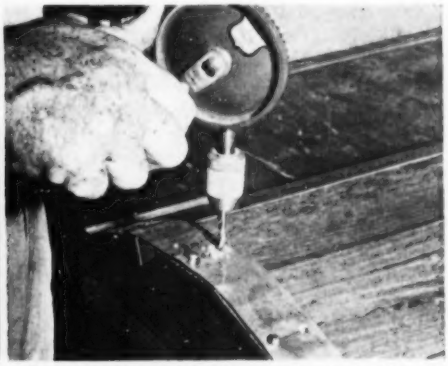
7 HEAVY BRASS HINGES are beaten and fastened to rear of chest. Brass hasp is also beaten and screwed to front of chest. An old padlock on the hasp will add to the effect.

2 BOTTOM SECTION is assembled before other two sections are added. Ends are joined to sides with ¼″ dowels and glue. Bottom is doweled at ends, nailed at sides.



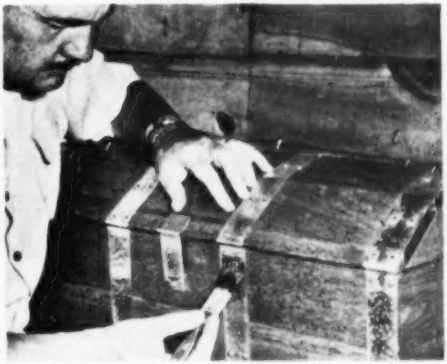
3 CUTAWAY DRAWING above shows construction of chest. Lid is formed by cutting 10° bevels on edges of 4″ boards. Two thin strips at each side of lid bring it to 18″ width.

5 CHEST IS BOUND with thin brass strips 1½″ wide. Strips are cut to length, beaten with ball-peen hammer and drilled for ⅛″ rivets. Chest has been given first coat of oak stain.



6 RIVETS ARE DRIVEN into undersize holes after ends of strips have been nailed to edges of lid and chest. A drop of cellulose cement in each hole will help hold rivets in place.

8 BRASS CHAIN attached to each end prevents lid from falling back when chest is open. Adjust length so opened lid lines up with back slope. Heavy brass handles go on ends.



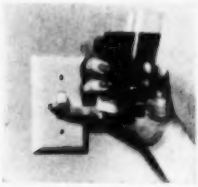
9 APPLY CLEAR LACQUER to brass after bringing up highlights with fine steel wool, and apply several additional coats of oak stain to darken wood and contrast with the brass.

New for the Handy Man

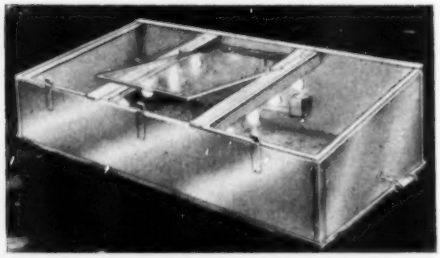
1. Plastic Tops You Can Apply. New materials make it easy for the handy man to install tough plastic work surfaces on homemade kitchen counters.

One laminated plastic (left above) needs no adhesive at all—it comes slightly bowed so that it will hug any flat surface when the edges are secured with metal edge molding. For covering walls, the edges are fastened by metal batten strips, which are then concealed by snap-on molding. The 1/10"-thick Panelyte is available in 11 colors.

At right above Formica is shown being applied with no fancier equipment than a rolling pin. A new quick-setting adhesive, which needs no clamping, is applied to both work and back of the 1/16" plastic, and allowed to set a few minutes. The panel is then pressed down with a rolling pin. The adhesive works on raw wood or old paint.



2. Sensitive Switch. This wall switch is so sensitive that it responds to the slightest touch—a big advantage when you have to work it with your hands full. Rated to carry 12 amp. at 115 volts, the switch has sterling silver contacts and is absolutely silent in operation.



4. Automatic Aluminum Hotbed. Eight 25-watt bulbs are controlled by a thermostat to maintain growing temperatures in 3′ by 6′ hotbed above. Another thermostat automatically opens the pivoted center sash for ventilation. Two sprinkler heads inside provide spray irrigation and plant food.

3. Wall Sealer. Scrub this water-mix paint on your basement wall and it stops seepage and dampness, says the maker. Called Silitex SF, the paint contains silicones and metallic compounds that enter the masonry and bind with it. In tests the paint sealed cinder blocks against an 8′ head of water.

5. Gas-Torch Kit. Using a popular throw-away fuel tank, a new kit provides instant heat for almost every need. Three burners give maximum, medium and pinpoint flames. Included in the kit are a diamond-point soldering tip for fine work, a chisel-edge tip for heavy soldering, and a paint-remover tip. The entire assortment is packed in a metal carrying case, which has an extra compartment for spare fuel.

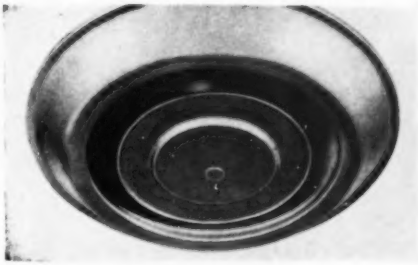
6. Adjustable Sash Balance. The tension of these concealed sash balances can be adjusted at the time of installation or afterwards without removing them from the sash. Tension can be applied to the L-type balance when it is being installed by turning the arm at the bottom. The other type is adjusted with a screwdriver. Both are made for a wide variety of sash sizes.

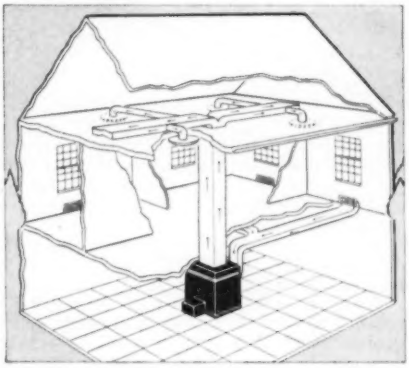
7. Paint Colors Masonry. All masonry surfaces – including stucco, cement, asbestos-cement shingles and brick–now can be coated in decorator-style colors. The coating, a rubber-base paint, is said to keep masonry surfaces free of stains, streaks or mildew and also to prolong the life of masonry by sealing it against moisture. It can be brushed, rolled or sprayed on.

Further information on these products can be obtained from: 1. St. Regis Paper Co. (Panelyte), 230 Park Ave., NYC 17; Formica Co. (adhesive), 4615 Spring Grove Ave., Cincinnati; 2. H. J. Theiler Corp., Whitinsville, Mass.; 3. Prima Products, Inc., 10 East 40th St., NYC 16; 4. Old Copper Mine Farms, Inc., RD 2, Box 198, Plainfield, N.J.; 5. Prepo Corp., Skokie, Ill.; 6. The Turner & Seymour Mfg. Co., Torrington, Conn.; 7. Sapolin Paints, Inc., 229 East 42nd St., NYC.

Ceiling Units Diffuse Hot Air and Blend It With Room Air

An improved hot-air heating system shown below has a central duct from which others branch out to circular ceiling diffusers. The diffusers (right) intermingle heated air with circulating room air. Grilles below the windows return cold air from floor level to the furnace. The system was developed by the W. B. Connor Engineering Corp., Danbury, Conn. Fuel economy is claimed because all heat is distributed. It is said that the desired room temperature is maintained even within a few inches of the diffuser units, which blend 4½ parts of room air to one of hot air.





Gas Heater Fits Between Studs

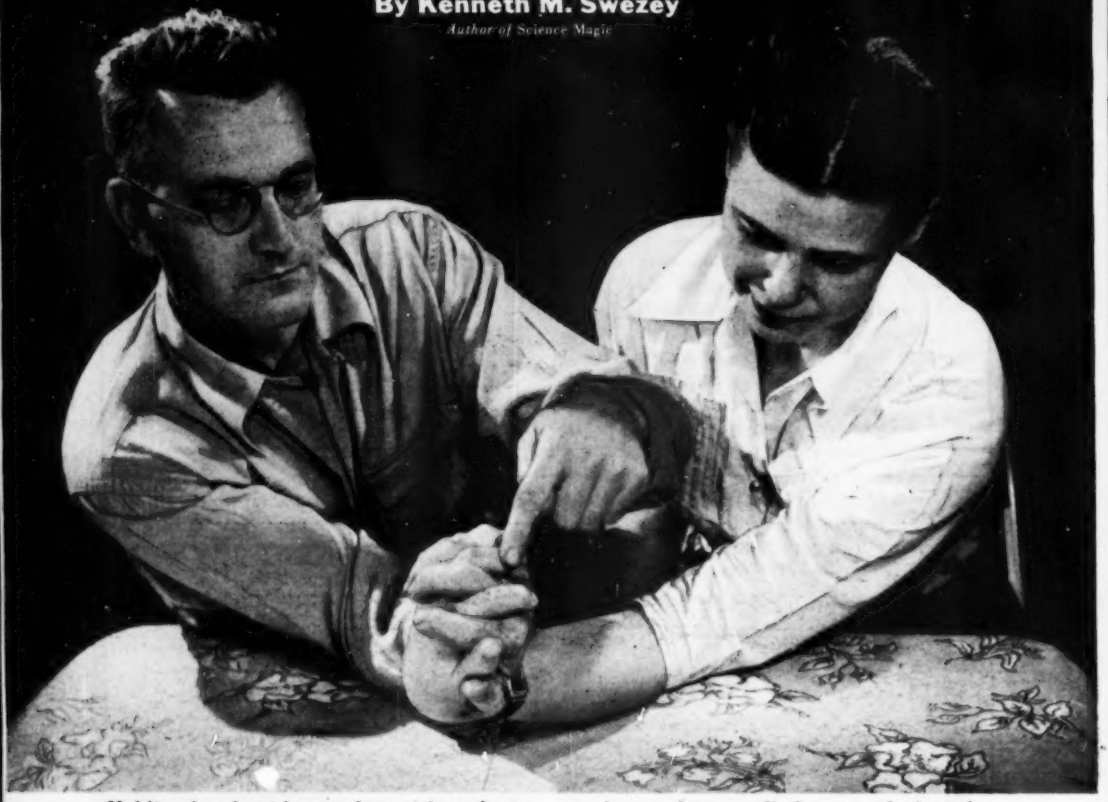
Gas-fired heaters tailored to fit between wall studs need extend only 4″ into the room. They are available as single units, facing one room, or as dual units, facing rooms on each side of a partition wall. A fan mixes and circulates the air. The maker, Coleman Co. of Wichita, Kan., says the casing never is too hot to touch.

Why Your Senses May Tell You Fibs

Maybe George Washington never told a lie, but your own senses don't always stick to the truth. Your eyes, ears, nose, tongue and skin can fool you—as these stunts show.

By Kenneth M. Swezey

Author of Science Magic



Holding hands with your best girl can be instructive as well as fun. Sitting as above, cross your right wrist over her left. Now both of you turn your hands inward until the palms face and the thumbs are downward. Interlock your fingers with hers and ask her to join you in twisting the clasped hands downward and then up between your respective arms. You now are ready for the real trick. (If this hand-wringing technique confuses you, try the bachelor version at the top of the facing page for practice.)

After achieving the contortions shown above, touch one of your girl's fingers with the index finger of your left hand and stroke it a bit in the interests of science.

Whose finger are you stroking? Your own? It does seem like it—as if it had gone to sleep. You have to look again to see whose it is.

Scientists explain it this way: Apparently the touch sensation, the motion of stroking, and the stroked finger being in a position ordinarily occupied by your own combine to create this strange illusion. But that's only one way your senses can fool you.

Which finger will move? Usually it is easy to move any finger a friend points to. But it becomes surprisingly hard in this illusion, an old favorite of psychologists. Using your own hands, you go through the same contortions described in the stunt at left—cross your wrists, put your palms face to face, interlock your fingers and then twist your hands under and up as shown by the arrow.

With your fingers thus entwined, have someone indicate (without touching) a finger for you to move. If you act quickly, the odds are that you'll move the wrong finger. Instead, you probably will move the corresponding finger on the other hand.

Why? Because your mind cannot determine which finger is which when your hands are in this unfamiliar position. Until a finger moves or you trace the source of each finger, your body-movement sense is completely baffled.

Two balls from one. If you trust your sense of touch, here's a stunt, handed down from Aristotle, that may change your mind. Without looking, roll a small ball back and forth between the tips of the crossed first and second fingers of one hand. You think you're touching two balls. That's because the touch sensations come from sides of your fingertips that, in their ordinary position, would signal two objects.

Plugging an ear aids your hearing in this case. Grip the watch firmly between your teeth and its ticking will seem loudest in the ear you have plugged. This shows that you can hear sounds by direct conduction through the bones of your head. The ticking seems loudest in the plugged ear because most of the external sounds are barred from the receptors in your inner ear and they don't drown out the ticking.

Don't trust your tongue, either. Food may taste bitter, sweet, salty, sour or have no taste at all depending upon where it touches your tongue. A cautious lick, therefore, may give you a wrong taste clue. On the tip, edges and back part of a tongue are taste buds that respond to all taste stimuli. An area about an inch behind the tip has no taste buds at all. Directly behind that area is another that recognizes no taste but sour.

Test this by applying a salt-sour solution (salt and lemon juice in water) to the tip of the tongue. There, it will taste both salty and sour. Apply it several inches back and it will taste merely sour.

See other stunts on the following page.

When hot seems cold. Heat a large nail by dunking in water at about 115°, dry it and then touch the point lightly to different spots on the back of your hand. On some spots the warm point will feel cool. This paradox occurs because sensations of heat and cold apparently are sent to your brain from different sets of receptors in your skin. Mild warmth sometimes stimulates the cold receptors. Because there usually are more cold receptors than warm ones, you get an illusion of cold.

How warm is warm? The rapidity with which your skin gains or loses heat also has a lot to do with what you feel. The hotter your skin, the faster it loses heat and feels cold; the colder it is, the faster it gains heat and feels warm. To see this, arrange three bowls as above. Fill one with hot water, the second with lukewarm water, the third with cold. Stick one finger in the hot water, another in the cold. Then put both in the warm water. The hot finger will feel cold, the cold one warm.

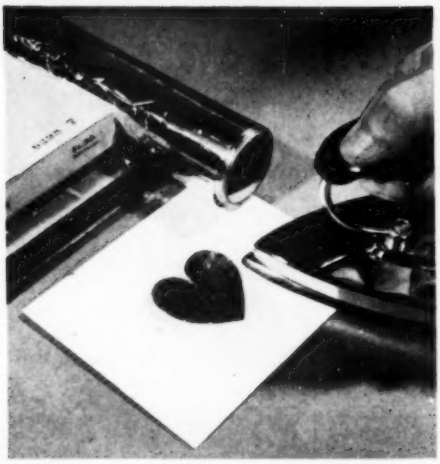
How to flavor your potatoes. Your tongue alone can identify salt, sugar, lemons and quinine, but your sense of smell horns in, too, to give you the flavor of such foods as fruit, strong vegetables, coffee and butter.

Blindfold a friend and ask him or her to bite a thin slice of potato while you wave an onion back and forth near the nose. The potato will taste like an onion.

Hey, it's wet! Or is it? You can trick someone into a feeling of wetness by holding a thin *dry* rubber balloon, filled loosely with cracked ice and water, against the back of his neck. Most physiologists agree that there are only four basic skin sensations: pressure, pain, warm and cold. Wetness, dryness, softness, roughness and tickle sensations are all synthesized from those basic four.

How many points? The acuteness of the sense of touch varies widely on different parts of the body. Tape two toothpicks to a stick and touch both points simultaneously to a blindfolded person's arm. On the back of the arm the points will feel like one, even though they are as much as 1½" apart. On the broad of the back or upper arm, you won't know there are two until they are at least 2" apart. But on the fingertips, two can be distinguished when less than 1/12" apart; on the tongue, two points less than 1/25" apart can be recognized as two.

Photo Tissue Mounts Foil



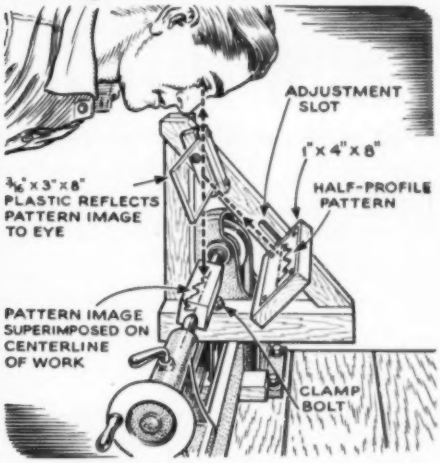
VALENTINE cards, gift packages and letters can be ornamented with brilliant heart-shaped cut outs of household aluminum foil. The foil is cut, laid over a piece of photo-mounting tissue and pressed with a medium-hot iron. It will be burnished brightly and will adhere to almost any surface.—*Ken Murray, Colon, Mich.*

What Would You Do?

I'm fussier about eggs than a hen. I like them cooked just three minutes, but I don't have a kitchen timer. I get along fine without one by keeping a pretimed record on my phonograph. As soon as I pop the eggs into boiling water, I start the music. When it stops I know my eggs are done.—*Robert Marie, Ft. Wayne, Ind.*

Have you pulled off a smart one lately? PSM will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.

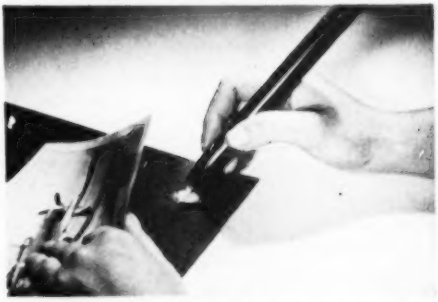
Turning Profile Seen on Work



THE reflected image of a pattern drawn on paper can save you the trouble of cutting out templates when turning duplicate pieces, such as chessmen. With the pattern in place, and the pattern board and plastic sheet set at the correct angles, the operator, looking down at the work through the plastic, sees the outline of the pattern superimposed on the work. It is then a simple matter to make a series of identical wood turnings by following the contours of this reflected image.

Parts turned in this manner will not pass a micrometer inspection, but they will look identical to the eye.—*James R. Gros, Dahlgren, Va.*

Pen Dispenses Drops of Glue



TOUCH the point of this pen to a surface and it leaves a small spot of adhesive for mounting photos or sticking together papers and gift wrapping. A spring-closing point prevents leakage. Refills can be had. *Glu-Pen Corp., 11 W. 42 St., NYC 36.*

How NOT to Take Pictures

Even professional cameramen sometimes confess boners that any beginning photographer is likely to make.

FIND an honest news photographer, induce him to bare his professional soul, and you're bound to uncover several surprising bloopers. Some will be good for a laugh. Others may be downright tragic.

Staff photographers on the *Milwaukee Sentinel* are not exceptions to the rule. They are accustomed to making 12 good pictures out of 12. But they do make blunders. After surveying office history, staffers Clarence Leino and Harry Michelfelder restaged the staff's choicest slips.

"I posed for most of the boners," says Leino. "But I don't admit to them all. I don't tell which ones are mine—for I still like to eat."

Forget the camera. Throwing his bag over his shoulder, one photographer dashed off on an important assignment. Ten miles away he remembered—no camera! A no-picture result is guaranteed.

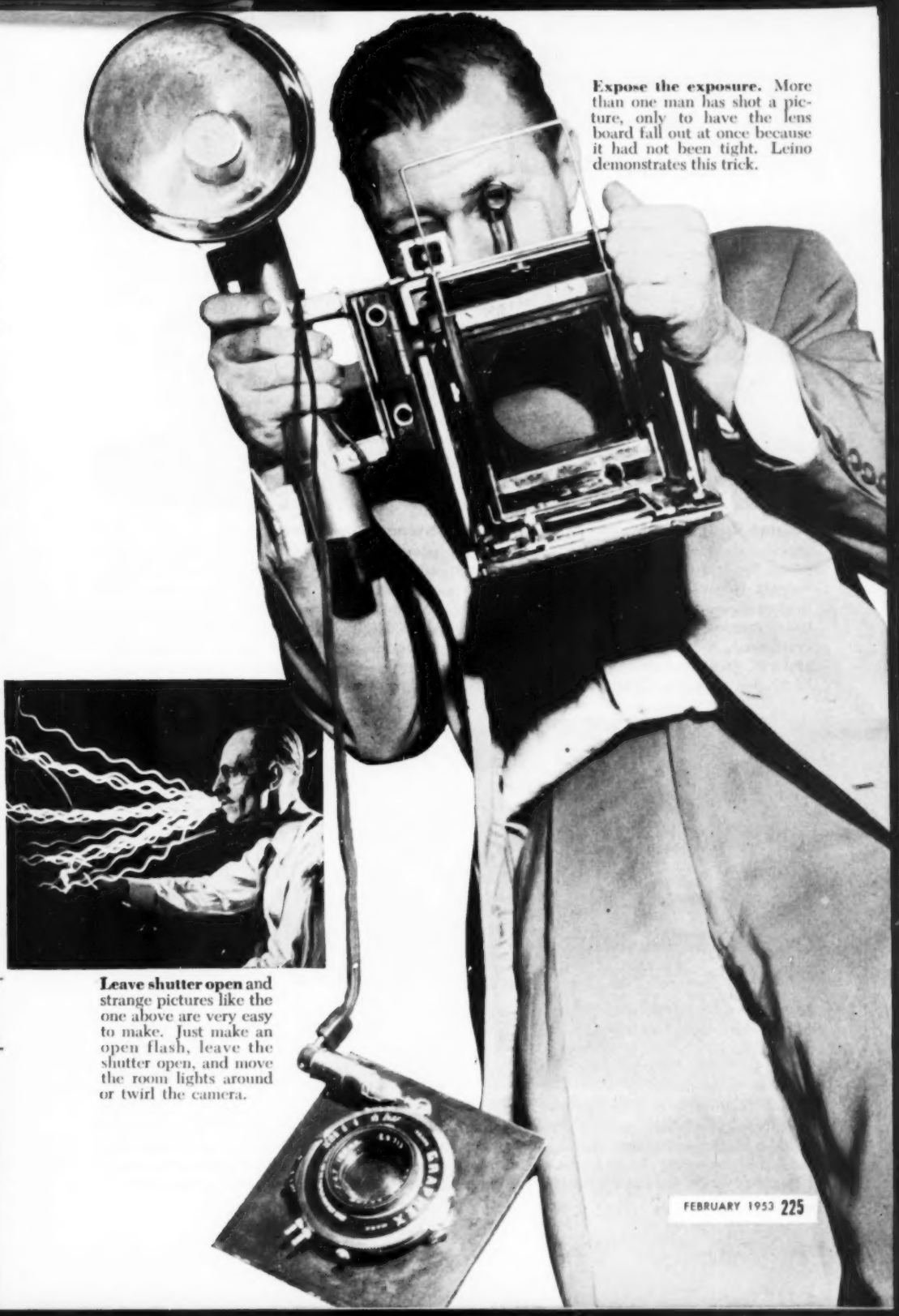
Two-headed monsters produced by double exposure are always waiting to cut a photographer's throat. Who hasn't pulled such a misbegotten image out of the darkroom soup? Be truthful now!

Leave darkroom open. Photographers knock before opening a darkroom, but scrub women don't. They may not come in shorts-clad models like this one, but they can ruin pictures just the same.

But which? Somewhere in this batch of holders is a single sheet of exposed film. No telling which one, for the photographer forgot to turn out the black side of the slide after making exposure. How can he find it? There's just one way. Develop them all.

Blank negative. Clarence Leino demonstrates typical look of a cameraman on first seeing a blank sheet of film fresh from developer. A sure way to achieve this with a Speed Graphic is to leave the back shutter closed when using the front one.

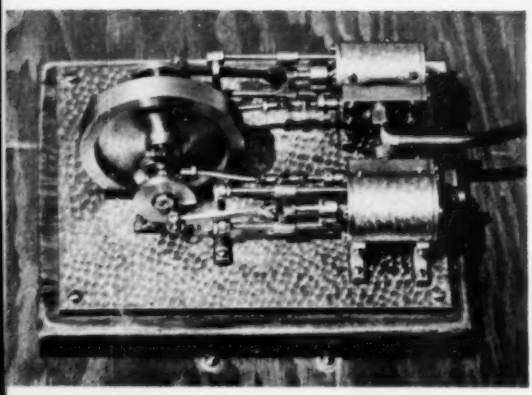
A trolley did it. One photographer always had such a full bag that the film holders bounced around on top of everything else. One icy night his foot slipped and an important holder bounced into the street. A passing trolley squashed it very flat.



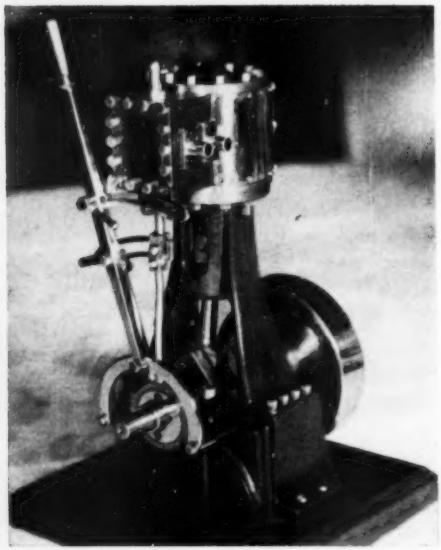
Expose the exposure. More than one man has shot a picture, only to have the lens board fall out at once because it had not been tight. Leino demonstrates this trick.

Leave shutter open and strange pictures like the one above are very easy to make. Just make an open flash, leave the shutter open, and move the room lights around or twirl the camera.

CRAFTSMEN AT WORK



Engine Built from Memory. Several years ago A. H. Fleischer of New Orleans saw plans for a two-cylinder horizontal steam engine. Recently, while stationed aboard a destroyer in the Pacific, he built this model from memory. Except for the base and crankshaft, it is all brass. It has a ¾" bore and a ¾" stroke and runs up to 3,000 r.p.m. on 12 pounds' pressure. Time: 125 hours to build.



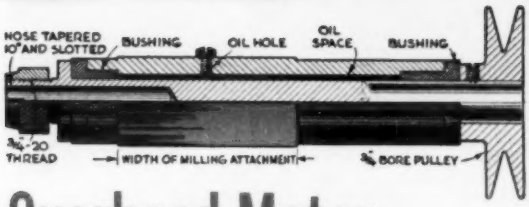
Steam Power Reverses. In 1947 PSM published the plans for this vertical steam engine (bore 1¼", stroke 1") with Stephenson reverse gear. Five years later, John David Brubaker, a senior at Manheim Township High School, Neffsville, Pa., came across the plans. He made all the parts from scratch except the piston ring—and won a top prize in a Ford contest with the model.

Variations on PSM Scooter. Home shops have been busy all across the country ever since that $75 motor scooter appeared in PSM (July, '51, p. 129). Here are three of the many versions built.

Carl Rozmarek of Chicago and his dad built theirs as a father-and-son project. They added a luggage compartment to the rear of the 1.2-hp. scooter. Its speed is 25 m.p.h.

Another model flies in a lightplane, giving easy town-to-airport transportation. S/Sgt. Eugene C. Breiner of Scott Air Force Base, Ill., built his so that the kingpin and throttle mount can be removed, making two units that can be stowed in a plane.

Tony Pisciotto of St. Albans, NYC, saw the PSM plans while stationed in England with the Air Force. After he returned to the United States, he made all the parts and assembled his scooter in three months.



Overhead Motor Drives Milling Spindle

This sturdy spindle riding in a steel body puts smooth cutting power at your fingertips.

THE king of the power tools has only one drawback: a lathe's entire cutting power is funneled through a fixed headstock. This overhead-drive milling spindle overcomes the handicap by providing smooth, chatter-free cutting power *anywhere on the lathe* that the carriage and vertical milling attachment can take it.

Long splines, flutes or keyways, otherwise impossible to cut, can be easily milled in straight or tapered shafts held between the lathe centers. The spindle chuck can take a variety of cutters and abrasive wheels to do extra duty as a tool-post grinder, horizontal boring machine or armature undercutter.

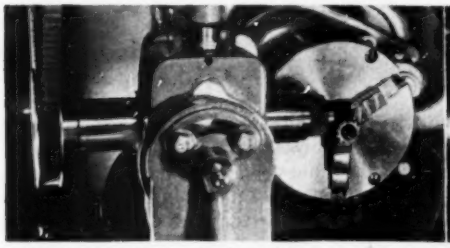
Steel body. The body was shaped from a 6″ length of 1½″ square cold-rolled steel. This was mounted between centers and both ends turned to 1 7/16″ diameter. It was then set up in the three-jaw chuck with the free end supported by the steady rest and drilled ⅞″ halfway in from each end. The ends were also faced.

Next it was clamped in the milling attachment directly in line with the lathe center, and a fly-cutter boring bar, mounted between centers, was used to counterbore one end to receive the bronze bushing. The boring bar was then reversed and the opposite end of the body counterbored. The two end bushings were turned and bored .750″ for the spindle.

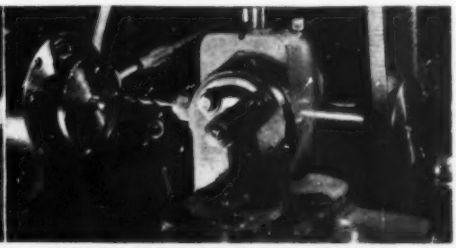
The spindle, turned from 1⅜″ cold-rolled rod, was completely finished externally while mounted between centers. The nose was threaded and tapered to 10°. The same 10° setting of the compound was used for boring the taper in the nose-tightening collar.

A piece of bronze was chucked and bored to a tight fit for the spindle, which was forced into it and bored ⅞″ to a depth of 2½″. The spindle was then clamped in the milling attachment and the expansion slots cut with a slotting saw.

The overhead drive consists of ball-bearing jackshaft and ¼-hp. motor bolted to a standard motor support. A 2-to-1 pulley ratio halves the jackshaft speed.—*Warren W. Lacey Jr.*

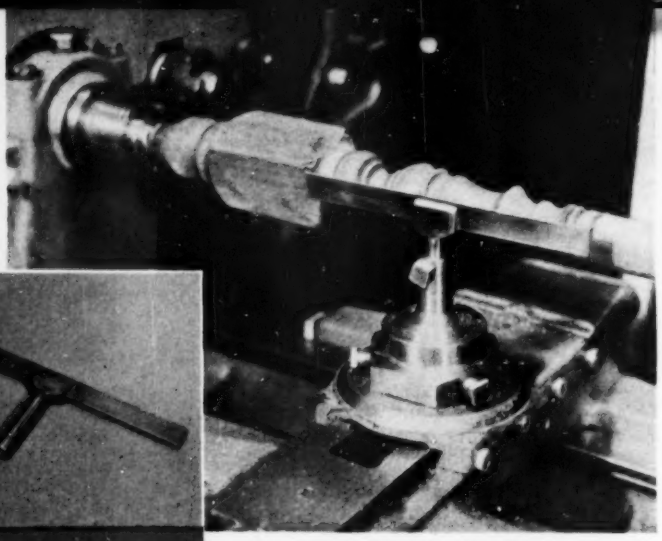


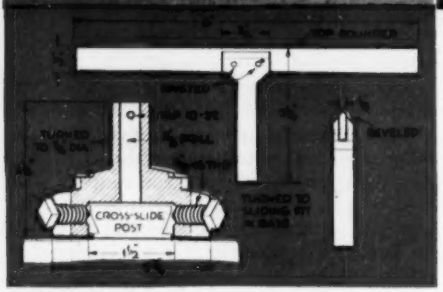
CUTTING SPLINES in shaft end is one of many milling operations performed by this spindle. Length of lathe bed is only limit to length of keyways or splines that can be cut with it. Long belt and sliding overhead-drive permit using spindle anywhere on lathe bed.



MILLING ATTACHMENT GUIDES SPINDLE up or down as needed. Turned parallel to lathe bed, it can drill holes in a perfect radius, using indexing gear on headstock to space them evenly. Oilite bronze bearings and solid construction permit heavy cuts.

NEW Shop Ideas





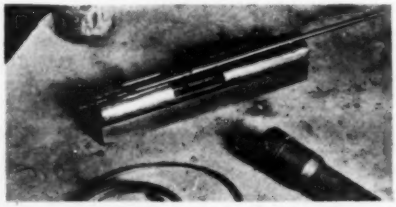
Tool Rest for Wood Turning. Occasionally the metal worker must turn out a few wooden handles or ornamental turnings. Such hand turning calls for a tool rest.

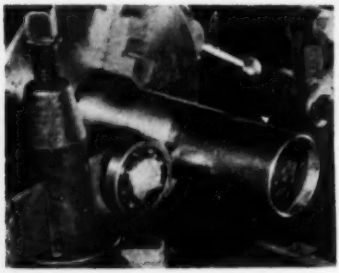
A large hex-head bolt found in a junkyard served as the base for this one. It was bored to fit over the swivel post on the cross slide and drilled ⅜" for the tee upright. If your lathe has the swivel post on the underside of the compound, duplicate this on your base. Drill and tap two holes in the base and one in the column for square-head brass setscrews.

The tee upright was turned from a 2¼" length of ¾" by ⅜" cold-rolled steel mounted between centers. The top was then beveled and a slot cut with a hacksaw to receive the tool rest. Two rivets complete the tee assembly.

The top of the tee should be slightly below lathe center when set at its lowest position.—*Will Thomas, Kenmore, N. Y.*

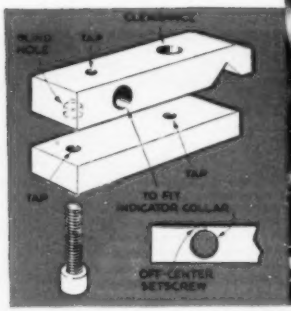
V Block from Steel Tubing. Two short lengths of steel tubing welded or riveted to a strip of steel bar stock make a sturdy V block for the drill press. Cut away in the center, the V block becomes a useful jig for brazing. At right it holds a drill and an extension rod in perfect alignment while they are brazed together for drilling deep holes.

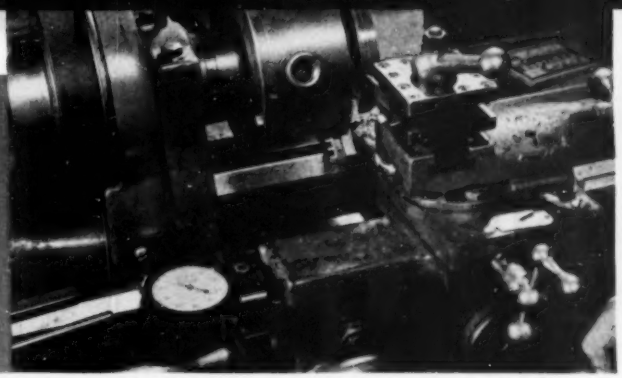




Rolling Tool Smooths Shafts. A ball bearing bolted to a steel bar will roll turned surfaces to a hard mirror finish, often eliminating the need for grinding. By work-hardening as well as smoothing the bearing surface, this process greatly lessens initial shaft wear, resulting in bearings that fit tighter after run-in.

In use the rolling tool is clamped in the tool post after the finish cut has been made, and brought up against the work with firm pressure. The diameter of work so rolled is reduced by only two or three ten-thousandths. —*Fred F. Davis, Edmonton, Alberta.*



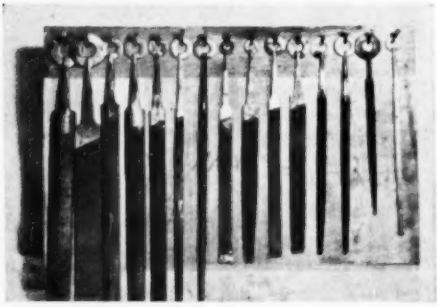


Indicator Carriage Stop. In cutting threads up to a fixed carriage stop, you have to shut off power a safe distance away and pull the belt to finish the pass. A dial indicator mounted as above will let you use power feeds for turning to a shoulder or threading right up to the undercut. The indicator should have at least ¼" travel. Only back-geared speeds should be used.

As soon as the carriage touches the stem, the needle starts moving slowly around. By throwing the half-nut lever at the same point on the indicator dial, you can stop the carriage at the identical spot every time. Feed the tool in the same amount for each pass.—*Floyd McGuckin, Ridgewood, N. J.*

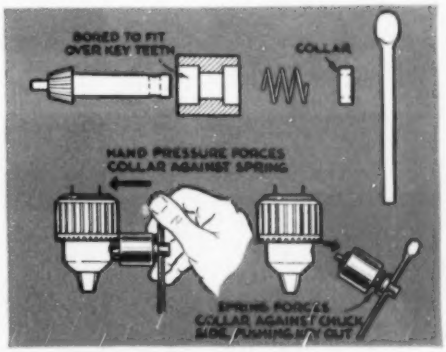
Marking Pen Is Shop Accessory. Felt-tipped marking pens, the type used to mark crates for shipment, are a very useful workshop tool. Filled with layout blue (left) they provide a spillproof method of coating work surfaces for scribing.

Filled with India ink (right) they make quick touch-ups over scratches on black-finished tools or instruments.



Washers Make File Handles. Solder or braze steel washers to the potentially dangerous pointed tangs of your files. They'll give you something to hold them by and something to hang them by. In addition, they will protect the palm of your hand from the point.

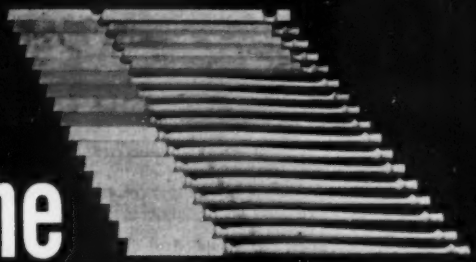
The flat plane of the washer in relation to the surface of the file adds a delicate feel to small files, enabling you to hold them in the correct position.—*Ray Millholland, Indianapolis.*



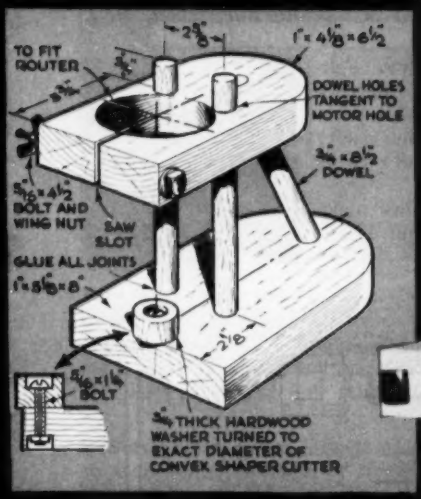
Safety Key Pops Out of Chuck. A collar turned to fit, and a light spring and washer, will convert your chuck key into a safety key that will pop out of the chuck when hand pressure is released. It also keeps your fingers out of the chuck teeth.

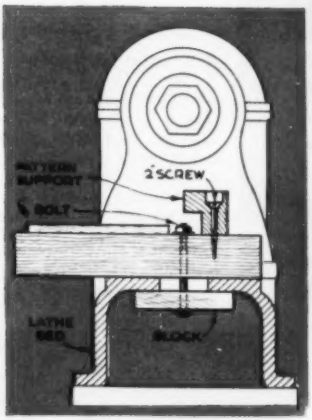
The key handle is removed and the parts slid into position. The handle is then forced into its hole, securing the assembly.—*Fred Barker, Ilion, N. Y.*

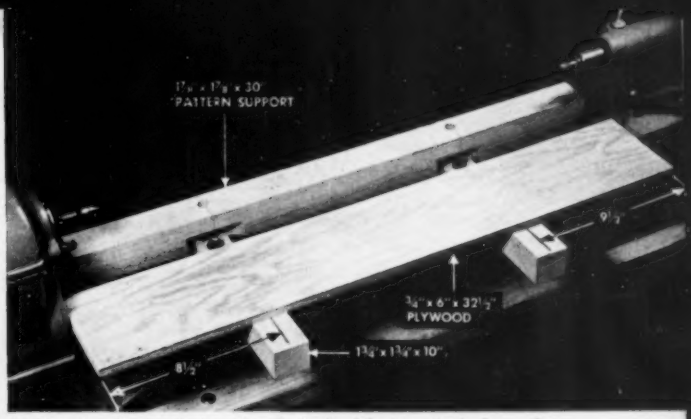
Routing in the Lathe



This ingenious rig changes two woodworking tools into a production setup that delivers identical turnings.







1 Wooden bed is fastened to lathe bed by two ¼" bolts and two hardwood blocks below lathe ways. Maple is a good wood for this. Countersunk wood screws hold pattern support to the two crosspieces. Whole rig must be rigid on lathe.

By Glenn A. Wagner

MAKING multiple turnings of identical shape is a ticklish job—even for an experienced woodworker. Long, slim, tapered table legs are especially hard to hold to dimensions by hand. But here's an easy way. You just set up your lathe for production turning.

These photos, taken while turning legs for some tavern-style tables in a home workshop, show you how it's done.

A portable router with shaper-spindle attachment and a wood-turning lathe are the basic tools. The router stand follows a pattern, turning out duplicate pieces as the work is rotated in the lathe. You can run the lathe at its slowest speed for some cuts, but the smoothest finish results when the work is turned by hand.

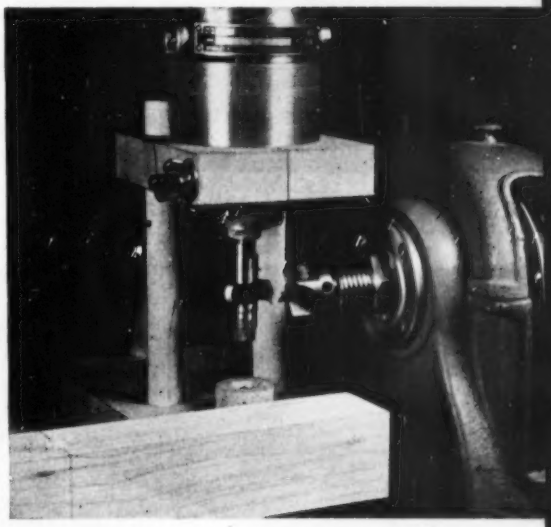
While this method of duplicating turnings saves time, it doesn't destroy the desirable handmade look of the finished piece. Some beads and coves may have to be finished by hand.

Fluting. When you complete a run of leg turnings, the same pattern can be reset to make a production setup for fluting the legs. Mount a fluting cutter in the shaper spindle. The lathe indexing gear is used to space out the desired number of flutes and to prevent the work from turning while the router travels along its length. A stop block at each end of the wooden bed limits the travel of the router, making all flutes identical in length.

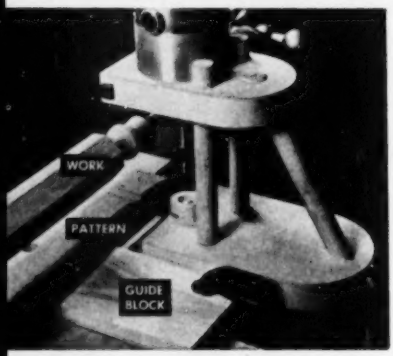
Using this setup and a broad, flat rabbet cutter, you can mass-produce slim legs that resemble segment columns of six, eight, 10 or more sides.

2 Front face of pattern support must be centered exactly below lathe centers. Adjust wooden bed and check with square until ends line up. Then tighten the bed bolts.

3 Shaper cutter is mounted as close to motor as possible. Adjust height of motor until center of cutter is in line with lathe center. Check to see that motor is vertical in holder and that cutter lines up with washer on base. **Please turn the page for six more photos.**

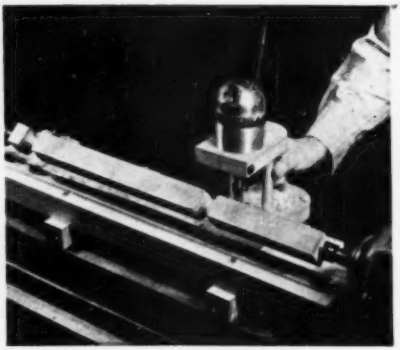


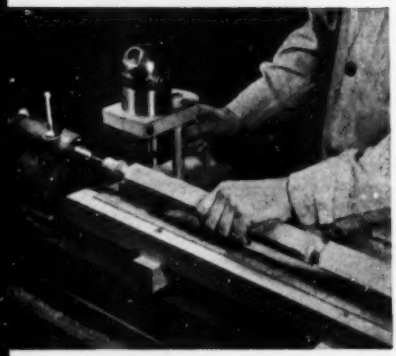
4 **Shaping pattern** can be ⅛" or ¼" hardwood plywood. Cut it about 1" longer than turning so shaper will feather off. Center the pattern between lathe centers and fasten it to the support with four small wire nails. Screws are better for long runs but nails will hold if the support is hardwood.



5 **Guide block** clamped to base (left) makes it easier to feed router straight into work for start of cut. Block isn't absolutely necessary but it simplifies making the first cut.

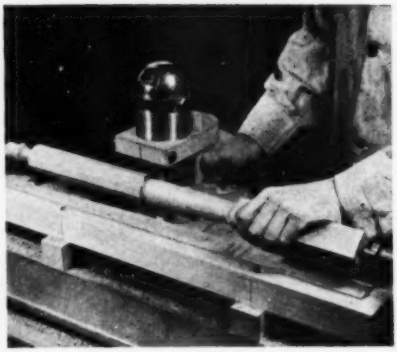
6 **First cut** was made near foot of table leg because this cut is deep. Material left on foot supports part where cutter would tend to chip work if such a deep cut were made later. Second cut was made near top of turning. Both cuts were made with lathe running at lowest speed while shaper was fed slowly into work.



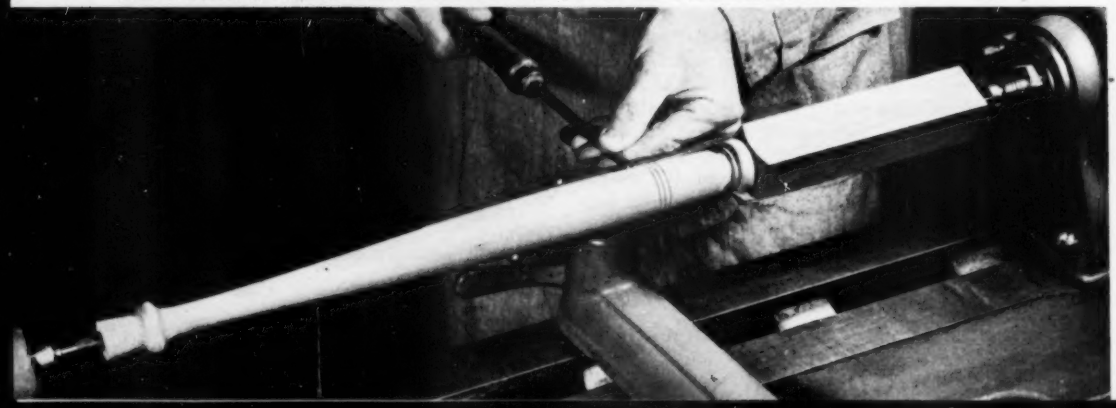


7 **Thumb and finger** guide the router stand along the pattern (left). Work is turned with left hand. Corners of stock have been cut on circular saw.

8 **Long taper** can be made after basic cuts are finished. Router is guided along pattern from headstock to tailstock as work is slowly turned by hand. Where cut will be deep, it is better to make one or two light passes to rough off excess wood. Finished cut will be a very fine spiral all along the leg.

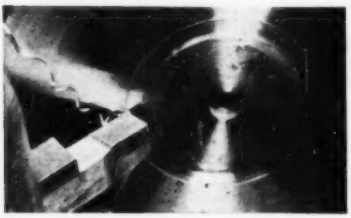


9 **Finishing** is done by hand after all legs have been shaped with router. The wooden bed is removed from the lathe and a skew chisel is used to make a scraping cut that removes the spiral left by the router. Then the leg can be sanded in the lathe to final smoothness. END



Adhesive Joins Two Different Materials by Curing Process

ADHESIVE is applied like glue, but resemblance ends there. Plastilock is cured by oven heat after solvents have air-dried to form bond that no ordinary glue can match. Carbide tip, bonded to steel bar below, withstands heat and pressure of machining stainless steel with no coolant other than cutting oil. Adhesive will bond nearly everything but rubber.



DEVELOPED originally for fastening linings to brake shoes without rivets, a new synthetic resin-rubber adhesive called Plastilock 604 is now being packaged in pint cans for home-shop use. B. F. Goodrich Co., the manufacturer, reports that the material has extremely high holding power, citing tests on plastic-to-glass joints where the glass broke before the bond did.

Plastilock comes in two forms—a tape that is laid on the surface to be joined, and a liquid that is brushed on. The liquid is best suited for all-around work. Work must be thoroughly cleaned and degreased, and the liquid adhesive applied to both the surfaces.

The surfaces are then joined, clamped lightly and set aside overnight while the solvent evaporates. Heat lamps will hasten the evaporation process. The work, which is now lightly stuck together, is clamped together more firmly and placed in an oven at 350° for about an hour. This cures the adhesive and the work is allowed to air-cool slowly, completing the bond.

The adhesive works equally well on metals (even difficult ones like aluminum), wood, glass, plastics and cloth. Price per pint is about $1.25.

Lampblack Lines Crucibles

MOLTEN metal and dross won't stick to a crucible if it is first given a lampblack lining. Make a paste of lampblack and water, coat the inside of the crucible, and heat it to dry the lining. After use, just dump the crucible to clean it.

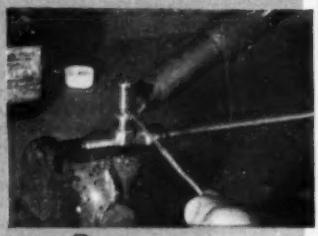
Workshop Wisdom

To clean his lathe spindle, Joe Hurning
Inserted, while it was still turning,
A finger, alack,
Which he didn't get back.
To manage with nine he's now learning.

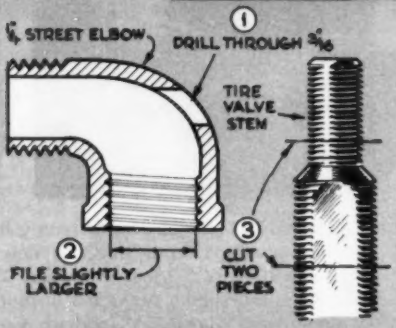
Separating Nested Elbows

PIPE and duct elbows come from the factory in a ring or nest as shown above and must be sprung apart by force. The sharp edges make this an awkward and dangerous job to do by hand. If you buy elbows so packed, you can avoid the possibility of a bad cut by laying the nest on the floor and kicking with a heel against one of the joints until the elbows fly apart.—*Cornelius Oster Jr., Rushville, Ind.*

WORK SITTING DOWN. With this foot-operated outfit, both hands are free to handle the work and the gun. Foot pump is less tiring than a hand pump. The outfit can be used anywhere.



TWO-WAY FITTING puts air in at one end, takes it out at another for smoother flow. It's made from a standard elbow. Pieces of valve stem take couplings on pump, gun hoses.



Foot-Powered Tire Pump

This outfit is ready to go to work anywhere. It costs less than $10, even if you must buy all the parts.

ALTHOUGH I own a husky compressor and spray gun, I always used a brush to do touch-up jobs or paint models and other small articles. It just takes too long to clean the gun after a small job—almost as long as if I had sprayed a house wall.

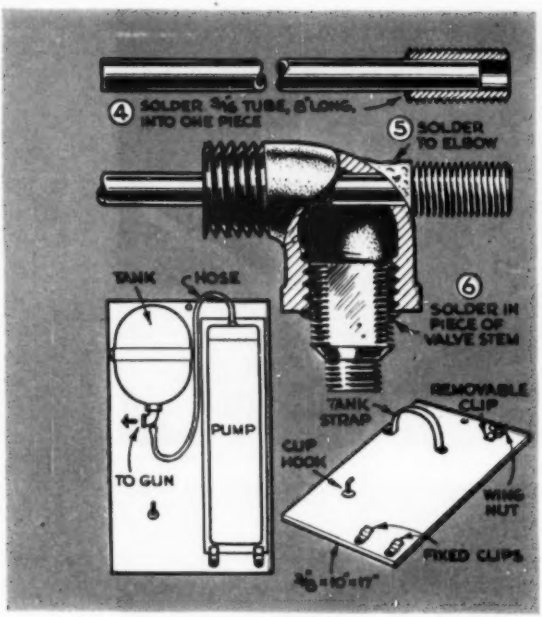
With this foot-pumped outfit I can spray anything from a toy car to wrought-iron furniture, and put the gun away before you can say "clean the brush."

I simply screw on a jar that I've chosen from a battery of extra jars filled with the most-used colors. When finished, I substitute a jar containing thinner, blowing a bit through the gun to clean it. Using lacquer this way, I can finish metal from primer to gloss coat in 30 minutes.

Buy ready-made parts. The gun is a simple atomizing type with a trigger valve, sold at auto-supply stores. Any tire pump could be used. A foot-operated one leaves both hands free and is easier on the biceps.

MAIN PARTS are a tire pump, a small spray gun designed to work with air from an auto tire, and a cheap war-surplus oxygen tank.

MOUNTED ON A BOARD, outfit is hung up when not in use, gun and all. Pump can be detached when needed elsewhere by loosening a clip held by a wing nut and unscrewing the hoses.



Sprays Paint

To smooth out the air flow and keep the gun spraying on the up stroke of the pump, a chamber of some sort is needed.

This could be an old aerosol bomb, a piece of large pipe capped at both ends, or any other container that will stand moderate pressure. I settled for a 104-cu.-in. surplus oxygen tank, available for less than two bucks.

Assembly is simple. Both the pump and the gun are connected to the tank. But with a simple tee in the single tank opening, air streams directly across and pressure drops three pounds between strokes. The homemade fitting shown reduces this drop by half. It's made by soldering parts of a valve stem and a piece of tubing into a ¼" street elbow. No rethreading is necessary.

Using the outfit. The jar that came with the gun is only 1½" high. To use higher jars, I slipped a piece of rubber tubing on the spray tube so that it reaches the bottom.

Paint must be thinned for spraying, and tests should be made on scrap to determine the proper consistency. Since thinners are inflammable, work should be done only in a well ventilated place, away from fire.—*Howard G. McEntee, Ridgewood, N.J.*

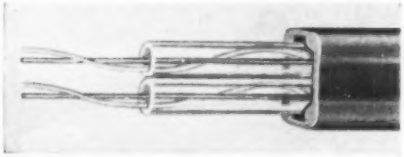
Kit Makes Flint Arrowheads

EVERYTHING needed to turn out real arrowheads and spearheads is contained in this kit. Included are bone tools for shaping flint, a grooved block to hold flints, and rawhide to tie heads to shafts. It is available from C. W. Handel Associates, 171 Neal Ave., Newark, Ohio.

Pipe Carried Under Car

TO PROTECT your car's paint and chrome when you carry long lengths of pipe or lumber, hang them beneath the car. Tie the pipe or boards to the bumper guards as shown at right.—*Clinton R. Hull, Costa Mesa, Calif.*

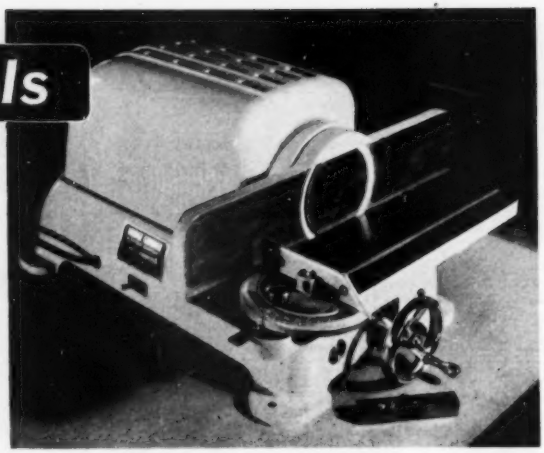
New TV Lead-In Handles UHF



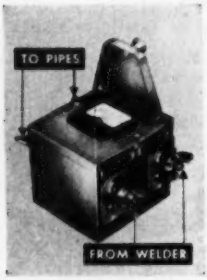
A NEW all-weather TV lead-in line, ATV-270, developed by RCA engineers and Anaconda Wire & Cable Co., is said to meet all the requirements for the reception of ultra-high-frequency broadcasts.

The high-strength copper wire is surrounded by a polyethylene spiral thread which centers it in a plastic tube. The twin tubes are encased in a brown plastic jacket that gives them complete protection against dirt, water and weather.

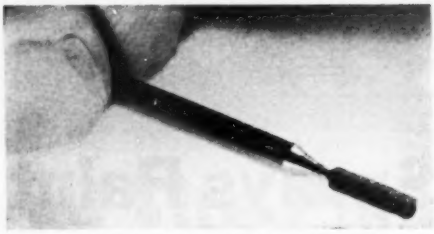
New Tools



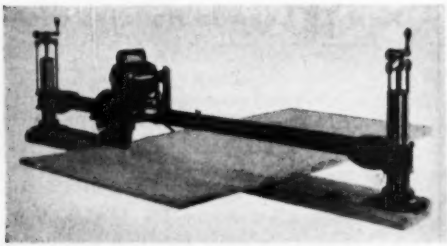
1 Grinder Works Like Jointer. A 5″ cup wheel protrudes slightly through the stationary fence of this grinder, giving a flat surface when work is moved by hand across the wheel. According to the maker, many surface-grinder jobs can be handled by this machine, including flat valves, straight-edged knives, con-rod caps, flat dies and castings. The fence is 3¼″ high, 4½″ wide and 18″ long.



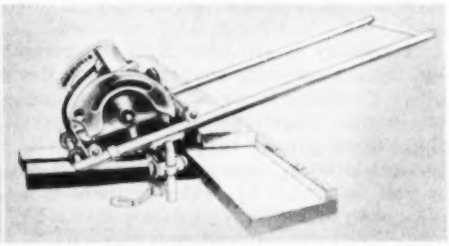
2 Overload Protection. When an engine-driven electric welder is used to thaw frozen water pipes, this protective device will prevent it from overheating or burning out. If the current load is too great, a special lag-type fuse will blow. An ammeter also indicates how much current is passing through the lines. The unit is made in several ratings for welders from 200- to 400-amp. capacity.



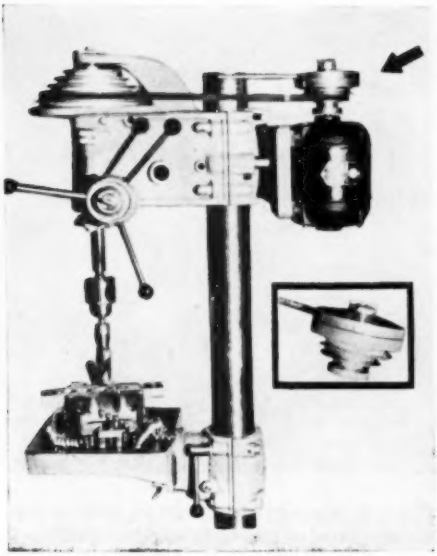
3 World's Smallest Grinding Wheel. Only 1/16″ in diameter, miniature mounted wheels or abrasive points like this have been developed to grind extremely small holes in bearings, bushings, instruments, and for similar precision operations.



4 Saw Cuts Panel. Cutting 4′ by 8′ panels of plywood or ripping long stock is a snap with the saw above. The saw is drawn through the work on two rails, available up to 10′ long. The rails can be tilted to 90° for mitering or rabbeting, and the depth of cut can be controlled by the screw jacks at each end. An abrasive wheel can be substituted for the saw blade to cut large sheets of metal.



5 Radial Seesaw. The portable saw on this carrier swings down as it is pushed through the work. At the same time, the arms press the work to the plank that serves as a saw table. When the saw is drawn back across the balance point, the arms swing upward so the work can be removed. The saw can be demounted for portable use or shifted crosswise in the carriage for ripping. It has a 24″ cut-off and rip capacity.



6 Speed Changer for Drill Press. This gear-reduction unit mounts directly on the motor shaft by means of a setscrew, giving the press a wide range of slower speeds for jobs a standard press couldn't handle. It comes in two models, one with 4½-to-1 reduction ratio and six speeds from 75 to 2,000 r.p.m. The other gives 7-to-1 reduction with six speeds from 45 to 2,000 r.p.m. Speed changing is done by engaging a driving key on top of the unit.

7 Magnetic Screwdriver. The permanently magnetized shank of this screwdriver not only holds one of the four interchangeable bits but also energizes it to pick up and position a screw for driving. Three bits not in use are stored in the metal cap in the Tenite handle. Two of the bits are for slotted screws and two for Phillips.

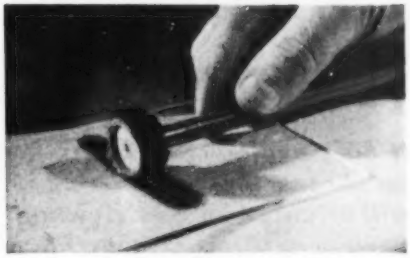
Further information on these products can be obtained from: 1. Southwest Machine Works, 1309 Bridge St., Albuquerque, N.M.; 2. Lincoln Electric Co., Cleveland 17, Ohio; 3. Chicago Wheel and Mfg. Co., Chicago; 4. Hendrick Mfg. Corp., 11 Selman St., Marblehead, Mass.; 5. See-Saw, 4140 Syracuse, Dearborn, Mich.; 6. The Pull-Gear Co., 21125 Dequindre, Hazel Park, Mich.; 7. Magna Tool Corp., 779 Washington St., Buffalo 3, N.Y.

Wood Base Supports Torch

THIS holder makes it almost impossible to tip over a tank torch. A base also is useful on hardening or tempering jobs when the torch is set upright and the work held in the flame.

The base is ½" plywood 6" by 6". The upright portion is ½" stock 6" high and of a suitable dimension inside to just clear the tank. A mending plate drilled and tapped for a small eyebolt secures the tank.

Roller for Painting Trim



NARROW trim, window putty and similar surfaces can be neatly painted with this roller. Saw a narrow section from a broomstick. Around it glue a strip cut from a lamb's-wool shoe polisher. Drill a hole in center, insert dowel handle.

Vacuum Sucks Varnish Dust

A HOOK scraper proved to be the easiest way to remove old varnish from woodwork in one remodeling job. To keep the dust to a minimum in the house, a vacuum-cleaner hose equipped with a small nozzle was held near the scraper so that it would pick up the particles.

How to Wash Your TV Picture Tube

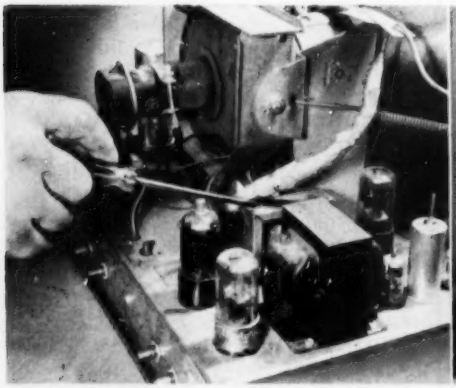
If dust has built up on its face, an old-fashioned scrubbing will brighten up your viewing.

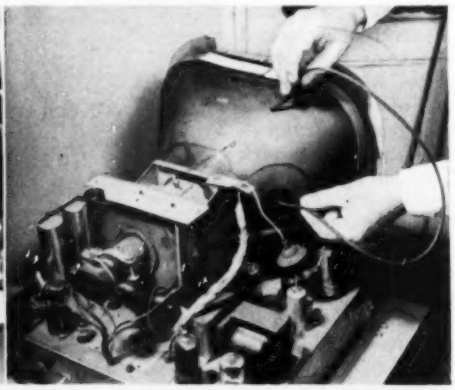
By John B. Ledbetter,
Engineer, WRKC-TV

LIKE a fog that moves in so quietly you don't notice it, a layer of dust is building up on the face of your TV tube, robbing you of clear, bright reception. High voltages and static charges draw dust and soot from the air and hold them tight against the tube.

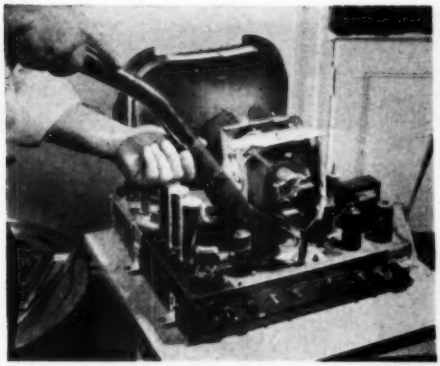
Washing the tube face is a simple job, but getting at it sometimes presents a problem. On some sets the safety glass can be removed from the front, exposing the tube face. A clip snaps over the screw-on bracket that holds the glass in place.

Most sets, unfortunately, are not so easy to clean. The majority are built with the safety glass screwed to the cabinet front





SET MAY STILL BE HOT even though turned off. To avoid unpleasant and sometimes dangerous shock from idle but fully charged condensers, touch a plastic-handled screwdriver firmly against the chassis or other grounded part and bring it down gently on the metal tube caps. This should be done before handling chassis. Picture tube itself may still be charged; remove rubber-covered high-voltage lead from side of tube and discharge surface of tube into terminal with heavily insulated wire (above).



DUST ON CHASSIS hampers air circulation and absorbs moisture and grease, hastening breakdown of high-voltage circuits. Blow it out if you can; otherwise suck it out with vacuum cleaner. Clean corners with a brush.

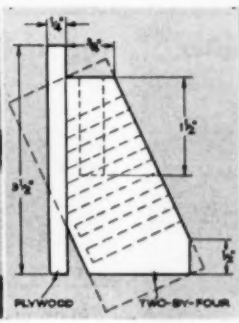
CLEAN SAFETY GLASS with mild soap and a damp, lintfree cloth. If yours is made of plastic, take care not to scratch it. Note brackets holding glass in place; look for them when deciding how to get at tube face.

from the inside. The tip-off is four or more little holding brackets that can be seen from the back of the set. To loosen these it is necessary to remove the front knobs and chassis-mounting screws (usually four under the cabinet), disconnect the speaker plug and slide the chassis out. On most sets the tube is secured by a bracket on the chassis.

Caution: If you find that yours is one of the few sets with the tube mounted separately in the cabinet, call in a serviceman to clean the tube. This kind of mounting requires that the tube be disconnected and removed before taking out the chassis, not a job for the inexperienced.

DRY TUBE FACE WITH TISSUE after washing it. Drape heavy towel over body of tube to protect you from injury in case of implosion caused by too much pressure or jarring. For maximum protection, also wear goggles.

Tool Rack Is Made by the Yard—Cut Off as Needed



A LENGTH of two-by-four cut to a 45° bevel and fitted with a back panel of ¼" plywood makes a handy catchall to hold small tools, files, drills and other thin objects.

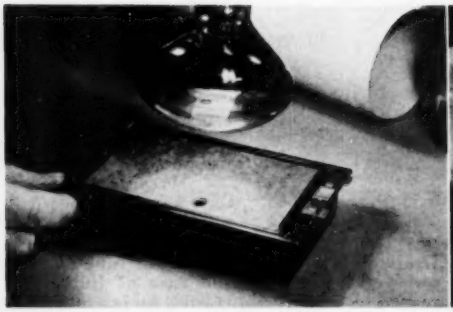
The beveled face and the strip along the top are drilled full of holes about ¾" diameter or larger for pliers, screwdrivers and such.

Short lengths can be cut off and spotted around the shop as needed, or the long length can be used across the workbench. If desired the rack can be screwed to the wall. —*Walter Haase, Hartford, Conn.*

Face-Lifting with

REPRODUCTIONS of wood grain, leather and marble that look like the real thing are possible with plastic veneer. This makes these thin-film refinishing materials especially useful in reclaiming articles that are headed for discard.

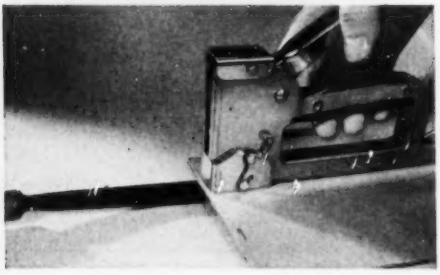
The veneer often can be cemented right over an old finish such as the exterior of a camera or the surface of an old piece of luggage. With it you can give books new covers, refinish furniture or spruce up an old portable-typewriter case.



HEAT LAMP softens veneer so that it can be molded over or around irregularities such as the rim of this camera's tripod bushing.

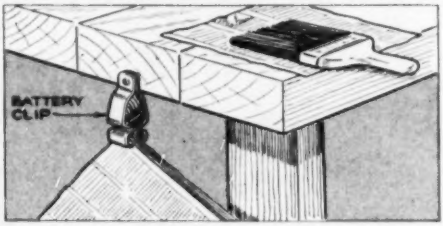
FOAM-RUBBER PAD forces heat-softened film into surface irregularities. Heat-and-pressure method will mold veneer around curves, too.

Tacker Is Heavy-Duty Stapler



A TACKER can be used for fastening cardboard or other materials that are too thick to be handled by a desk stapler. To clinch the heavier staples on the underside of the work, use a shallow concave wood chisel as an anvil.—*K. Murray, Colon, Mich.*

Old Newspapers Used as Wipers

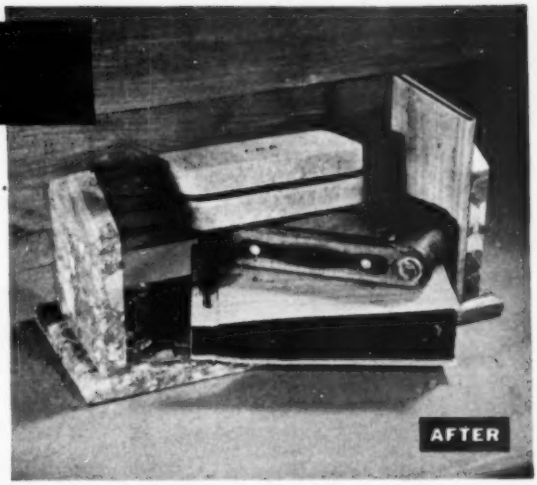


SCREW an alligator clip to the edge of your workbench or to a shop wall. It will hold squares of old newspaper that you can rip out of the clip and use to wipe a brush or clean up paint drips. Newspaper sheets torn into quarters will make a convenient size for this purpose.—*Max Moeller, Millburn, N. J.*

Plastic Venee

The material pictured here—Transveneer*—comes in sheets of many sizes and patterns. To use the veneer, you first soak it in water so that the protective paper can be removed from the patterned side. Then the film is cemented to the surface to be covered. If the surface is painted, it can be made adhesive with a "welding" solution furnished by the veneer company. Unfinished surfaces must first be given a coat of lacquer.—*W. E. Burton, Akron.*

*Di-Noc Co., 33 Public Square, Cleveland 13.



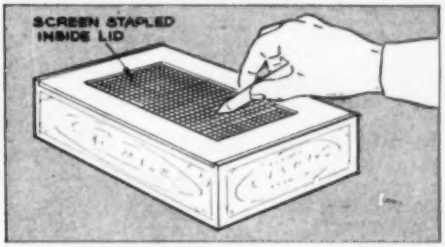
RUBBER SQUEEGEE smooths veneer on flat, even surfaces. The plastic veneer being used here reproduces the pattern and color of marble.

OLD CHEST was refinished with mahogany-grain veneer. The metal fittings and trim were replaced after the veneer had dried.

Springs Hold Clothesline Taut

TIGHTER than a drum is the way Mrs. Ed Marshall of Butte, Mont., describes her clotheslines. The posts are T-shaped 4" pipe with holes in the arms for eyebolts. Non-rusting wire is attached to the bolts and under the nuts of each bolt is a coil spring. The springs permit slight sagging but pick up the slack as soon as clothes are removed. —*E. V. Reyner, Townsend, Mont.*

Window Screen Sharpens Chalk

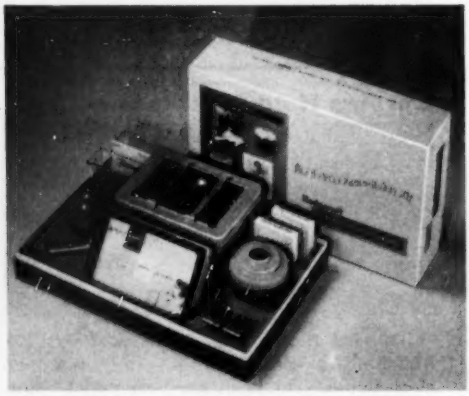


THIS simple sharpener puts a keen point on chalk and also catches the chalk dust. It's a cigar box with a rectangle cut out of the lid and a piece of window screening stapled inside the lid. The chalk is rubbed across the screen.—*James F. Bahr, Fresno, Calif.*

So you always thought a darkroom was dark and mysterious, hard to set up and expensive. Well, here's good news. The old-fashioned darkroom has now emerged into the light of day! All you need is (1) a sink and (2) one of the Kodacraft outfits you see here. And when you want to branch out, all you need do is add inexpensive accessories such as you see on the opposite page. Ask your Kodak dealer to demonstrate this equipment.

Kodacraft Printing Kit (*displayed above*) **costs only $4.95.** You can have a world of fun watching your own pictures appear for the first time in a printing tray. And think of the pleasure you can have in making duplicate prints for friends, making greeting cards for special occasions. Use of the Kodak Velite Paper included in the kit permits printing under the lighting conditions of most kitchens or bathrooms. This kit contains the essentials you need for printing pictures—three 5 x 7-inch rocker-type trays, Kodacraft Printing Frame with set of three masks for nine negative sizes, 25 sheets 2½ x 3½ Kodak Velite Paper, graduate, Kodak Tri-Chem Pack, Kodak Darkroom Thermometer, Kodak Glass Stirring Rod, and complete book of instructions.

Kodacraft Photo-Lab Outfit—$8.75. Includes basic essentials for developing and printing pictures—three 5 x 7-inch rocker trays; Kodacraft Printing Frame with set of three masks for nine popular negative sizes; quick-loading Kodacraft Roll-Film Tank with 620-120, 616-116, and 127 roll-film aprons for easier developing; 25 sheets 2½ x 3½ Kodak Velite Paper; 8-ounce graduate; 2 Kodak Tri-Chem Packs; Kodak Darkroom Thermometer; 2 film clips; and instruction booklet.



Kodacraft Advanced Photo-Lab—$14.10. Offers complete developing and printing equipment, featuring the easy-to-use Kodacraft Metal Printer for negatives to 4 x 5½ inches. Other items: three 5 x 7-inch rocker trays; Kodacraft Roll-Film Tank with 620-120, 616-116, and 127 roll-film aprons; Brownie Darkroom Lamp, Model B; 25 sheets 2½ x 3½ Kodak Velite Paper; 8-ounce graduate; 2 Kodak Tri-Chem Packs; Kodak Darkroom Thermometer; Kodak Glass Stirring Rod; 2 Kodak Junior Film Clips.

Kodacraft Roll-Film Tank—$2.53. The easiest tank on the market to load. Includes aprons for 620-120, 616-116, and 127 film.

Kodacraft Miniature Roll-Film Tank—$2.53. Permits simultaneous development of two rolls of 35mm. film or Bantam-size film (828).

Kodak Blotter Roll—$2.88. Corrugated backing allows air to circulate and dry prints more rapidly. Keeps prints from curling up.

Spring-wound Kodak Timer—$7.20. Covers all intervals up to 60 minutes. Both minute and split-second hands. Tilting base.

Kodak Electric Time Control—$13.50. Automatically times printing. Printer or enlarger plugs into control. Repeat timing possible.

And when you want to expand operations, you have a wide choice of inexpensive Kodak accessories

Kodak Utility Footswitch—$10.00. Keeps your hands free. Controls enlarger, printer, or safelight lamp. Dull light marks location.

Kodak Automatic Tray Siphon—$4.50. Converts sink or tray into automatic washer. Attaches to water tap. Washes prints, films.

Kodak Masking Easel 11 x 14—$9.60. Facilitates cropping, holds paper flat. Heavy, non-wobble felt base insures steadiness.

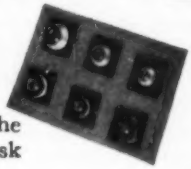
Kodak 2-Way Safelamp—$4.50. Its unique construction permits direct or indirect lighting—or both. Safelight filter and bulb supplied.

Kodak Adjustable Safelight Lamp—$7.40. Has double-swiveled shank and bracket. Attaches to wall, bench. Includes safelight filter.

Kodak Hobbyist Enlarger *(left)* **—$44.00** (incl. lens). Most brilliant enlarger in this price field. The secret is a highly reflective coating inside enlarging head. Cold-light illumination protects negatives. Rotating negative holder loads easily.

Kodak Flurolite Enlarger *(right)***—$99.50** (without lens). Has all the advantages of the "Hobbyist" plus many more uses. With accessories, the 2¼" x 3¼" "Flurolite" quickly converts for copying, slide making, other uses. Cold-light protection for negatives.

Kodak Enlarging Lenses *(right)* for the "Flurolite" range from the Kodak Enlarging Ektanon Lens, 50mm. *f*/4.5—$14.00 . . . to Kodak Enlarging Ektar Lens, 4-inch *f*/4.5—$49.90.



Your Kodak dealer will be glad to start you off the right way in developing and printing pictures. Ask him all about it the next time you see him.

Prices subject to change without notice

Eastman Kodak Company, Rochester 4, N. Y.

Kodak
TRADE-MARK

Engine Helps Steer '53 Studebakers

[Continued from page 117]

duction. It was invented by Bill Barnes of Muncie, "father of the overdrive." It is manufactured by the Warner Gear Co. of that city, acts upon steering gears made by the Ross Gear & Tool Co. of Lafayette, and helps guide a car built in South Bend.

At first, it will be available for the Commander series only, though the Champions are expected to get it later in the year.

Design Goes Continental

The decidedly new look of Studebaker's 1953 bodies—especially the Champion and Commander hard-top convertibles—is the result of a stylist's dream come true. Several years ago, Raymond Loewy, head of the firm responsible for styling Studebakers, asked Studebaker president Harold Vance to permit the boys at the drawing boards to try their pencils at a stimulating, unconventional exercise.

Why not, he asked, let them see what kind of a car they can design if they have no limitations except those that a designer of foreign cars might face? Foreign cars are generally lower in relation to length than U. S. cars are. This project was not to be allowed to interfere with the stylists' regular work, so Vance told Loewy to let the boys loose.

They promptly set out to design a car with exceptional visibility, lower windowsills and a sportier look. One specific goal they had was to bring the windshield posts and the windshield itself back closer to the driver.

Nose Like Airplane

After the usual preliminaries on paper, stretched out because this was being done "on the side," and after six months of leisure-time study of quarter-scale models, the Studebaker styling section produced a full-scale model. It was a low, racy job with a nose slightly resembling that of a Constellation airliner.

The mock-up might possibly have gathered dust, however, if it hadn't happened to be completed just prior to an annual meeting of the board of directors. At the close of the meeting, partly by way of entertainment, Vance ushered his directors in to see the unconventional mock-up. It made an instant hit.

"When," remarked one of the eminent visitors, "do we start building it?"

The designers were flabbergasted when the production heads eventually decided to make their dream a reality. That sort of thing happens in the automobile industry about as often as Halley's Comet appears.

Model Becomes the Real Thing

The car that actually is the original mock-up translated into a production model is the hard-top convertible, a truly handsome vehicle, as the accompanying photos show. Practically the only change made in the process was that of raising the over-all height half an inch. Even at that, the car stands only 56 5/16 inches high. The body design is to be identical for both the Champion and Commander hard tops and moderated somewhat for the sedans.

One entirely unexpected result of the advanced design is the elimination of wind noise from opened vent flaps. That had been plaguing Studebaker owners—as well as its designers—for years. Just about the time that the engineers had finally produced a vent that wouldn't howl, they discovered that the new body contours had changed the air flow in such a way that the vents no longer caught the wind and didn't screech anyway. Now you can talk comfortably in a Studebaker and enjoy fresh air at the same time, even at 75 miles an hour. END

It's the Other Guy

There's nothing so gratifying,
When a cop's siren stops you dead,
As to have him go by you eyeing
Some car that's up ahead.

—*Fireman's Fund Record.*

RACING'S MOST COVETED AWARD AGAIN WON WITH CHAMPION SPARK PLUGS!

Chuck Stevenson, 1952 AAA National Racing Champion and winner of the stock car division of the Mexican Road Race.

The AAA medal awarded for the best record in 15 big car races totalling 2400 miles.

"When you're up against the best drivers and cars in the nation you want spark plugs that stay with you," says Stevenson. "For my money there isn't a spark plug in the world to compare to Champions and I give them full credit for helping make 1952 my big year. Practically every top race driver I know, here or abroad, will tell you Champions are the best!"

The spark plug chosen by Chuck Stevenson—and by nine of the first ten AAA drivers—must be the best—and that means Champion! This preference by those whose lives and livelihood depend on engine performance means that when *you* pick Champion Spark Plugs you are buying finer performance, economy and dependability. Whatever make or model car you drive—*it will run better with Champions!*

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

CHAMPION

SPARK PLUGS

Better by Far for **EVERY CAR** *Regardless of Make or Year*

Amateur and professional craftsmen get a special kick out of the unusual in the tools they add to their equipment. Here are some special files that will warm any tool user's pride. The Nicholson or Black Diamond trademark assures their practicality and quality. If your hardware dealer doesn't have them on hand, he can get them for you through his wholesaler.

1. **LATHE FILE** with teeth cut at a long angle to "slide" out the chips and prevent them from scratching work being smoothed in lathe.
2. **BRASS FILE** with special "non-clog" teeth cut for use on brass and other tough ductile metals.
3. **4-IN-HAND** file-rasp with two kinds of cutting surfaces on both half round and flat sides.
4. **ALUMINUM TYPE "A" FILE** for soft aluminum and aluminum alloy castings. Small teeth "scallops" break up filings, help clear out chips.
5. **LEAD FLOAT** with stubby "blade"-like teeth for "floating" or "shaving" away extra-soft metals, such as lead, babbitt, pure copper.

For free pamphlet, "*Ten Special File Types,*" and free book, "*File Filosophy,*" on kinds, use and care of files, write to –

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19 Acorn Street, Providence 1, R. I.
(In Canada, Port Hope, Ont.)

BLACK DIAMOND TRADE MARK

NICHOLSON FILES *FOR EVERY PURPOSE*

Small Trains Are Big Business

[*Continued from page 156*]

enthusiasts, and Ulrich resigned from his North American job. Opening a plant of his own, he sold a total of 10,000 signals as fast as he could turn them out.

Ulrich is constantly adding other items. His track cleaner, patterned after a Santa Fe water and tool car, spreads a light oil-cleaning fluid through a spring-loaded felt shoe onto the rails. And 14,000 hobbyists fell like a ton of coal for the little Ulrich drop-bottom gondola car. Introduced in July, 1952, it has eight doors in the bottom. They actually open and close at the touch of a finger!

On the other side of the picture, there is nothing accidental about Albert R. Kurtz and Albert R. Kurtz Jr. pooling their resources in the model-railroad business. What is unusual about this father-son team is that both are ordained ministers in the Lutheran Church.

From Garage to Factory

Albert Kurtz Jr. has been keen about model trains since he was seven, and he is now 28. He organized Kurtz Kraft Models Co. four years ago in the family garage in Burlingame, Calif. He had a single, hard-headed reason—to piece out his slender income while studying and during his early ministerial years. His first product was a semaphore signal. That was followed by a crossing gate, a searchlight, a lamppost, a switch machine and a switch control. Now located in Long Beach, Calif., the company grossed the sum of about $30,000 in the year 1952.

There's your model-railway market. But if you have an idea for an oscillating Diesel headlight, or a toy commuter who always misses his train, you'd better think twice before you put it into production. You, too, could lose a good hobby. END

Still Learning

"How long did it take your wife to learn to drive a car?"

"It will be 10 years this fall."—*L & N Magazine.*

Here's a job you can do

REFINISH YOUR BATHROOM with Armstrong's M-67 Monowall

You can remodel your own bathroom, and save money doing it, when you install Armstrong's M-67 Monowall.

Monowall is a tempered hardboard panel finished with a tough plastic called M-67*. This durable surface offers amazing resistance to hard knocks, stains, dirt, and harsh solvents. Its nine decorator colors come in three smart patterns . . . tile, plain, and streamline. Armstrong's M-67 Monowall is available 4′ wide and in lengths up to 12′.

If the old walls are in good condition, you simply cement Monowall right over them. The whole job can be done with ordinary hand tools. You can cover the entire room, or only the lower walls. The joints and edges are trimmed with neat metal channels. Your lumber dealer will give you more information on this practical wall covering. For the free booklet, "How to Install Armstrong's M-67 Monowall," write the Armstrong Cork Company, 9202 Lincoln Street, Lancaster, Pennsylvania.

* T.M. applied for

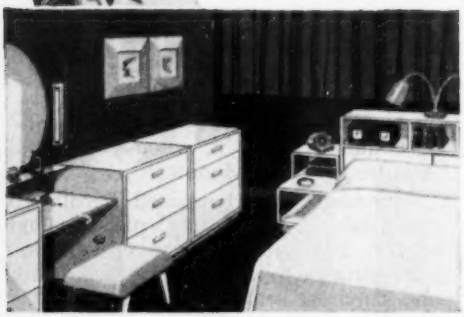
Cut Monowall to size . . . trowel on cement . . . and press into place

ARMSTRONG'S BUILDING MATERIALS

Temlok® • M-67 Monowall® • Cushiontone® • Insulating Wool • Hardboards

"I built our modern bedroom for only $76.50*

saved $301 with my SKIL Home Shop Saw and Sander"



Want a real feeling of accomplishment? Get yourself a SKIL Home Shop Saw and watch your wife's eyes light up when you make your own beautiful furniture.

Take this modern bedroom—detailed in SKIL-Chart No. 109. You can build it in no time with the simple-to-follow instructions and a SKIL Saw to cut sawing time and work 90%! You see, it's *easy* to bevel, miter and rip even 2-inch lumber with your SKIL Home Shop Saw. All adjustments are simple and quick.

Even the lowest priced SKIL Saw is by far the most powerful saw at *anywhere* near its price. You save money building things for yourself. So much so that your SKIL Saw quickly pays for itself. Add this to the fun and pride of creating things, and you see *why* you should get started now. Send coupon with 10¢ for SKIL-Chart No. 109—today!

SKIL Deluxe Home Shop Saw—Model 586—$59.50. 6" saw. SKIL Saw table (right) and accessories easily convert this saw to tilting arbor bench saw, sander and shaper.

SKIL Home Shop Belt Sander $68.00

SKIL home shop Tools

Prices subject to change without notice. *Bedsprings and mattress extra. Price includes materials only, and varies locally.

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In Canada: Skiltools, Ltd., 3601 Dundas Street West, Toronto 9, Ont.

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5033 Elston Ave., Chicago 30, Ill.

I enclose 10¢. Please send SKIL-Chart No. 109 showing how to build the above modern bedroom furniture.

Name_____

Street_____

City_____ State_____

Buick V-8 Has Dynaflow Plus Gears

[Continued from page 162]

flat, horizontal surface, reducing the chance of oil leaks.

It does something else—it narrows the engine down by several inches. You can see one result of that when you step on the brake. The narrower engine left the builders enough room up front to position the brake pedal for both right- and left-footers.

You'll remember that I remarked last month on the squabble going on among Detroit manufacturers on the design of combustion chambers. Buick goes in for the short, swirl-type chamber.

New Pistons Reduce Wear

Finally, Buick's new engines have full-skirt pistons instead of the "slipper" type. That's hard to quarrel with. Full-skirt pistons reduce the chance of slap.

It was almost a foregone conclusion that Buick would offer power brakes for 1953. As optional equipment, power brakes are becoming as common—and welcome—as power steering. Even the announcement of air conditioning didn't surprise me much.

12 Volts Give More Juice

What did please me was the addition of something that England has had for a long time. It's rare when you find any electrical trouble in those pint-size cars we import from Britain. Their owners never worry—a 12-volt system is insurance that even with a loose connection, the voltage drop won't be enough to disable a starter. The spark is hotter. Wiring is lighter.

For years American manufacturers have clung stubbornly to a six-volt system. Buick has 12 volts for '53. END

High-Hat Horn

Automobile salesman: "And what kind of a horn would you like, sir? Do you care for one with a good loud blast?"
Sailor: "No, I'm being transferred to Boston; just give me one with a refined sneer."—*L & N Magazine.*

HOW BOSTITCH MAKES THESE JOBS EASY

Tacking upholstery to chair seat, Bostitch T5AD Air Driven Tacker lets operator do it with one hand. Just squeeze, and Bostitch Tacker shoots staple into work. Drives staples almost as fast as operator can guide tacker . . . four times faster than hammer and tacks. Does the job faster and with less effort. Eliminates mashed fingers, damaged work, sore mouth from holding tacks.

Attaching pad to chair seat, Bostitch Stitcher takes only one-third the time. Does a neater, cleaner job. Stitcher makes its own staples inexpensively out of steel wire. Surer, stronger, easier than hammer and tacks. And they are only one-tenth the cost.

Sealing cartons, Bostitch Autoclench does job three times faster than tape and glue. Makes strong, neat seal with wire staple. Ingenious action clinches on inside entirely from the outside. Eliminates mess of water, smell of glue, cost of tape.

BOSTITCH is solving fastening problems in hundreds of different industries. Speeds production, boosts profits, makes jobs easier for workers. Let the Bostitch economy man help you with your fastening job. 300 fieldmen in 123 cities in U. S. and Canada. Write for free booklet.

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Please send me booklet of helpful suggestions for fastening.

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BOSTITCH®

fastens it better, AND FASTER with wire

The How of Ford's

Dr. Roy K. Marshall explains one of the 41 "Worth More" features of the '53 Ford

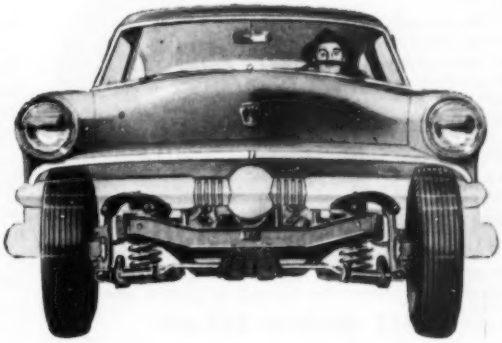
● "A popular misconception is that a car has to have excessive weight to ride smoothly and evenly. Yet, if weight were the main factor, then heavy trucks would ride better than passenger cars! The secret of a smooth ride is not weight but the coordinated action of such ride controlling elements as shock absorbers, front and rear suspension, tires, and seat springing. Ford engineers have developed this concept to a remarkable degree in the new '53 Ford . . . in fact Ford's new Miracle Ride reduces rough roads to 'carpet smoothness.' "

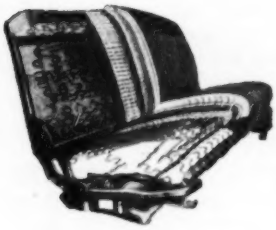
Visit your Ford Dealer and try Ford's Miracle Ride today

new Miracle Ride

How road shock is reduced 80%. "When Ford chassis engineers increased the vertical travel of the front wheels and softened the front suspension compression bumpers in the '53 Ford, they reduced front end road shock by as much as 80% ! Then rear springs were redesigned to just the right resiliency for precisely harmonized action with the front springs, so that the car moves up and down evenly without 'pitching' from front to rear. The development of more responsive shock absorber action was the next step—an all-important one to obtain perfect coordination between 'shocks' and springs at both front and rear. The result was an amazingly soft, smooth, *level* ride on boulevard or rough back road."

How a wider front tread increases stability. "A car with a wider tread in front is far less susceptible to sidesway, especially on curves. So Ford engineers designed the front tread two inches wider than the rear tread for greater stability. They mounted rear shock absorbers diagonally to further reduce 'heeling.' "





How foam rubber cushions help. "The little road shock that *can* get past the chassis gets no further than Ford's foam rubber cushions. They sit soft, but firm, on non-sag springs, add the comfort of living room chairs to the other advances of Ford's new Miracle Ride."

'53 Ford

White sidewall tires optional at extra cost. Equipment, accessories and trim subject to change without notice.

WHAT DO YOU WANT?

A GOOD BUSINESS OF YOUR OWN?

A HIGH PAY SPARE-TIME JOB?

Then FOLLOW THIS PROVED SUCCESS PLAN!

Here is your chance to be your own boss, secure financial independence, build a future for yourself and your family in a profitable business in your own garage or basement. J. S. of Michigan writes, "I figure my profits (last season) at over $1,000.00." Mr. C. H. R. of Ohio says, "This season I have taken in $3,688.20." J. P. of Pennsylvania writes "I spent only 40c for a newspaper ad and have done nearly $500.00 worth of business." Another owner writes, "I have had 4 mowers a day brought to me since last May . . . and do the grinding evenings at an average of $2.50 each." Think of it! That's $10.00 an evening in spare time. If you want to get ahead, make big money, be your own boss. Act Now. Write today for full details of our proved success plan.

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can the inside face and edge of the stationary blade, and all reel blades, be ground to proper clearance

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SEND THIS COUPON *NOW*

ROGERS MFG. CO., Dept. P-23, Lindsey, Ohio
Please send me full details about the profit possibilities of Lawn Mower Sharpening.

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ADDRESS_____

CITY_____ STATE_____

Gus Meets a Deadline

[*Continued from page 198*]

hard. When the line wouldn't accept any more air, he held the pressure, waiting to see if it would drop. But there was no leak. Gagan took his finger away and Gus blew through it again. No obstruction.

"Look, can you remember any other peculiar symptoms?"

"No." Gagan looked at his watch.

"Well, tell me exactly what was going on when it first happened."

"I was on a detour, lots of rocks and stuff worrying me, you know how they fly up. So I wasn't paying attention to the engine. It just quit."

Gus sighed.

"Ahh, don't worry about it, Gus! It's just the breaks. I can always get a fill-in from one of the mayor's assistants. It was the pictures that worried me most. And I think this wing of mine will be okay in a couple of days. Let's get going—if we can."

The Rocky Road to Trouble

The battery had received enough of a boost in the short running for Gus to start the car again without resorting to the crank. They rolled along for a while. Rather than ride the clutch, Gus stayed in second to keep the engine racing.

Suddenly, Gus lifted his foot from the gas, slowed to a stop and cut the ignition. "Your episode with the rocky detour . . . I just thought of a new angle."

Gus slid under the car and began tracing the fuel line from front to back where it hugged the frame. He had covered three-quarters of it and was ready to throw his hunch away when he found the trouble concealed in muck and grime. Gus tried repairing it with his pliers, but the untempered copper only cracked and tore. Painfully aware of the time left, Gus cut the offending section out, robbed the windshield wiper of its rubber hose, and joined the two ends of the fuel line.

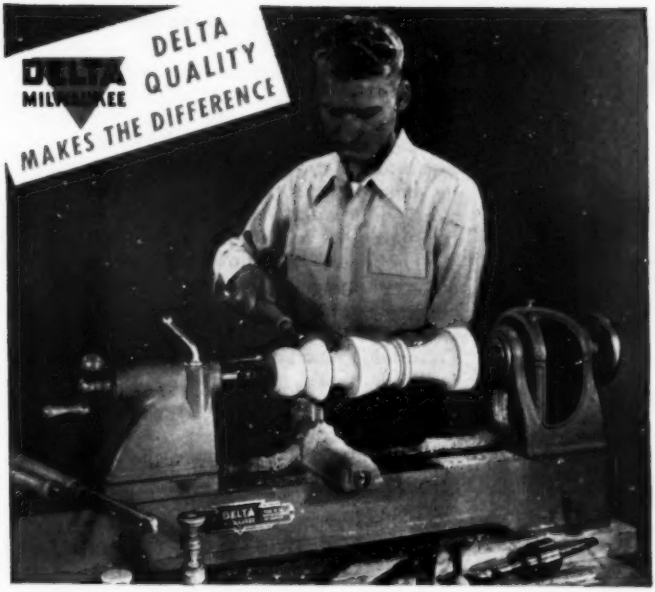
Engine Was on a Starvation Diet

He got back in the car, where Gagan sat nursing his shoulder, and told him the story while he plugged the remainder of the wiper hose with a matchstick.

"I wish you had mentioned those rocks before." He started the car and drove off at a normal speed.

"Didn't seem important."

[*Continued on page 254*]



Know the Fun of Working with a Fine LATHE Know the Satisfaction of owning a DELTA

Check these outstanding quality features:

- heavily ribbed bed for strength and rigidity
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- double-row index mechanism built into headstock—invaluable for quick division of spindle or face-plate work
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- 5/8" hole through headstock for repetitive work on rods and dowels.
- graduated tail stock sleeve machined inside with a No. 2 Morse Taper and adjustable pointer for convenience in drilling work held in chuck
- handy lever locks tailstock to bed—ball lever at rear locks or unlocks tailstock sleeve in one easy movement
- set-over tailstock—easy to align—centers accurately
- slide rest and other attachments for light metal turning available at small cost
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A fine lathe means you can do work better, faster and easier. Yet a high quality machine doesn't mean high price—not when it is DELTA. Be sure to see this tool at your Delta Dealer's. Note its many quality features and its wonderful-value price.

Handy Deltacraft books teach you how to use power tools—give plans and instructions for many wonderful projects. Use the coupon.

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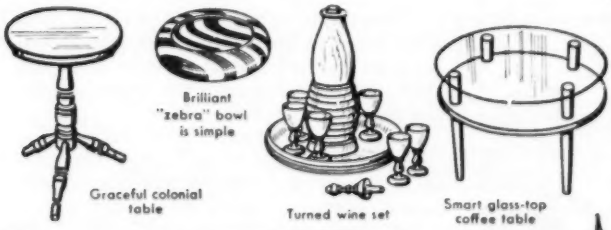

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● Of course you know oil-pumping usually means worn-out piston rings—but maybe you don't realize all that ring *replacement* means.

As your engine gets older, the cylinders wear tapered and out-of-round. The engine runs hotter because of accumulations in the cooling system. It needs more oil on the cylinder walls. Yet this extra oil must be kept under full control —so you get generous lubrication without a bit of waste.

This calls for a special type of piston rings—*replacement* rings.

Hastings makes replacement rings exclusively . . . devotes all its research, on the highways and in the laboratory, to the particular replacement problems of each make and type of engine . . . for re-ring, re-bore and re-sleeve.

Hastings rings are nationally known for their ability to stop oil-pumping, check cylinder wear, restore engine performance.

At the first sign of oil-pumping or performance drop-off, go to your motor specialist. If rings are the trouble he will gladly install a Hastings Steel-Vent replacement set. Truly the best money you can spend on your car.

HASTINGS MANUFACTURING COMPANY, HASTINGS, MICHIGAN
HASTINGS LTD., TORONTO
Piston Rings, Spark Plugs, Oil Filters, Castle, Drout

Gus Meets a Deadline

[*Continued from page 252*]

"Evidently a rock flew up and partially collapsed the line. I say partially, because you'll remember we found no sign of restriction before. Simply, your engine had to run fast in order to pull the fuel past the pinch in sufficient quantity. Slow running made your pump work too slow, and the restriction overpowered it. Your engine starved.

"The reason it didn't stall back in the alley was that I had leaned the mixture out and the fuel above the pinch lasted a little longer. When I get it back to the garage I'll install a new line for you."

"Well, that's one problem eliminated. But my shoulder . . . Did you ever try to take a one-arm shot with a heavy press camera? Gus. . ."

Gus Refuses to Play Photographer

"No!" Gus saw it coming. "Impossible! I won't do it!"

"But it's simple. I'll show you how."

"Look, you typewriter jockey, the only camera I ever used was a box Brownie. It takes a genius to run that one of yours!"

"Okay. So no photos of the mayor. Big stuff in a town like ours. It may mean my job. But you're a mechanic, not a newsman."

Gagan was still pulling the long-face routine when they drove into the area marked off for the ceremonies. The crowd was there already, and the mayor launched into the long-winded first paragraph of his speech. Gagan jumped out of the car and began struggling with some one-handed note taking, while Gus nervously cradled the expensive camera in his arms.

Then, in a popping of flash bulbs, somebody handed the mayor a shovel.

Everything Goes Wrong

"Gus, please. The camera is all set. You don't have to do anything but aim it and push the button! Everybody else is getting shots. Look, you want the paper to be scooped by these out-of-towners?"

"Okay, but don't say I didn't tell you!"

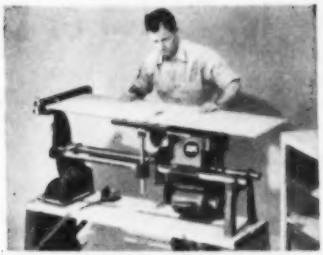
Gus stiffened his lip and aimed the camera. He snapped the shutter just as the mayor bent and marked his spot to dig.

"No, no, no," Gagan whispered. "Get something dignified, not the seat of his pants!"

The second shot went off in Gus's face before he could aim it. Gagan groaned.

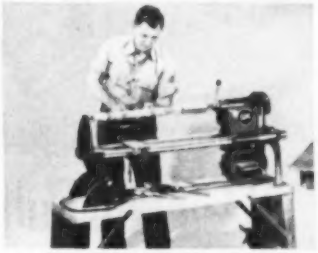
[*Continued on page 256*]

Will the power tool you buy have these quality features?

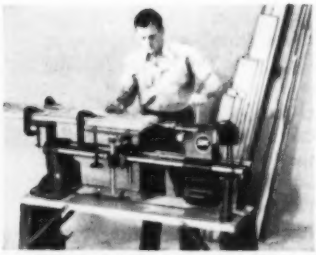


EXTRA CAPACITY AS CIRCULAR SAW Effective table size of 54" x 17" allows you to cut to center of an 8' panel. Up to 48" between fence and blade!

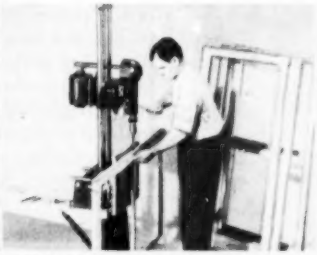
If you're thinking of a SHOPSMITH it has, because there's no costly duplication of parts. Therefore, SHOPSMITH can *afford* to give you top quality, through and through. You have *one* four-ball-bearing arbor assembly . . . *one* strong, substantial table . . . *one* precision headstock . . . *one* heavy-duty motor. Multi-purpose SHOPSMITH is the largest selling power tool in America because it packs the most quality in the smallest space at the lowest cost. Fill out and mail the coupon for the 16-page illustrated booklet—it's free!



UNUSUAL CONVENIENCE AS LATHE Tool rest slides parallel to workpiece; instantly adjusted and locked in position *without stopping motor.* Turn flat or hollow pieces while *facing* work!



LARGE CAPACITY AS HORIZONTAL DRILL PRESS Drills, bores, reams, countersinks. No limit to length of work! Makes dowel drilling easy, accurate; precise right-angle drilling.



REAL PRECISION AS VERTICAL DRILL PRESS Stress-proof ⅝" steel spindle, induction-hardened tip. 4 ball bearings, centerless-ground quill. Drills to center of 15" circle! 27" chuck to table.

EXTREME ACCURACY AS DISC SANDER Large, rigid table. Miter gauge is precision jig for any angle. Accurate "jointing" of edges. Disc can be fed *into* work for sanding duplicate parts.

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Motor* and bench extra

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Please send my free copy of the SHOPSMITH catalog and the name of my nearest dealer.

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Sudden temperature changes need not make your winter driving a nightmare. A CARTER Carbureter, properly serviced, can give you really dependable carbureter performance—no matter what the thermometer says.

Be sure this winter! Have a new CARTER Carbureter installed in your car! Look under CARBURETER in the yellow pages of your phone book for the address of your nearest dealer.

REMEMBER...
You'll Get a Liberal Trade-in on Your Old Carbureter

CARTER CARBURETOR CORPORATION
St. Louis 7, Missouri
Division of American Car and Foundry Company

Gus Meets a Deadline

[*Continued from page 254*]

"Take it easy, will ya! Flaming curses on this shoulder. . . Look, I only brought six plates. Try to get one decent shot!"

No matter how he tried, and how Gagan directed him, nothing seemed to turn out right. Gus stewed about it all during the hurried trip back to town. He dropped Gagan at the *Times-Chronicle* office and took the car back to the Model Garage.

Gagan Calls Gus

Gus was home that evening when the phone rang. It was Gagan.

"I developed the pictures, Gus."

"You don't have to rub it in, Will."

"Three of them were absolutely useless, and the others gave the boss quite a surprise."

"I'm sorry. Why don't you tell him?"

"And lose my $100 bonus? Heck no!"

"Bonus—I don't get you. Bonus for what?"

"I wish I had dared to try something like this on the boss before. But he's always seemed so old-fashioned—"

"Wait a minute, Gagan! You didn't answer my question. Why a bonus?"

"For the pix."

"What pix? I thought they were all bad."

"Well, naturally, we couldn't use the one of your left nostril or the two double exposures. But the boss was crazy about the one of the mayor bending over to mark the spot to dig—his face *does* show—and the one of dirt flying at the lens with the mayor looking like he's standing in a grenade burst! What could be better, he says. None of the usual folderol of dignitary shaking hands with dignitary, waving magnanimously at the crowd, the delicate jabs with the shovel. Instead, Gagan, he says, you have shown our beloved mayor as a hard-working, industrious man, close to the soil, close to the pulse of humanity. . . That's what he said, Gus. How much of this bonus can I cut you in for?"

"Not one tarnished copper! Just never bring that camera around me again. I'm a box Brownie boy myself, pure and simple!"

END

Next Month: Gus becomes a short-term nurse.

Keep Moving

Mechanic: "My advice is to keep that car of yours moving."

Owner: "Why?"

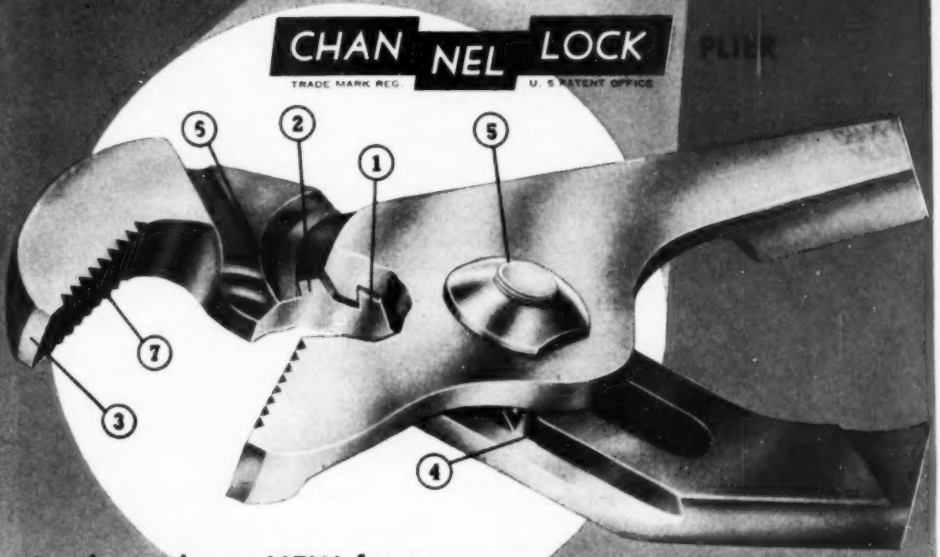
Mechanic: "Well, if you ever stop, the cops will think it's an accident."—*Lone Star Scanner.*

Here's the First NEW idea in plier design in years...

THE NEW No. 420

CHAN NEL LOCK PLIER

TRADE MARK REG. U. S. PATENT OFFICE



Look at these NEW features . . .

1. Interlocking principle positively prevents slipping under any load . . . the heavier the job, the greater the interlocking action.
2. New type wide base lugs provide maximum cross section strength . . . cannot shear.
3. New nose design provides greater utility for gripping small objects.
4. Patented design of tension edge provides more strength and eliminates stress concentration at channels.
5. New interlocking design minimizes stress on joint bolt.
6. Precision machined interlocking surfaces provide perfect fit, thus distributing pressure evenly.
7. "Rite Angle" teeth guarantee maximum bite and minimum wear.

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Here's the new, improved Channellock Plier—bringing to you new features which offer more positive gripping, greater strength and longer wear. The undercut interlocking channel is the first really new idea in plier design in years. Engineering skill has developed a plier with new patented features which give you the newest, strongest, most practical plier you can buy. Here is a plier that will last for years! Channellock Pliers—made only by Champion DeArment Tool Co., Meadville, Pa.

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Converts linear to board feet, gives nail specifications, tool sharpening tips, compares woods, answers countless other questions in seconds.

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ADDRESS.....

CITY..... STATE.....

Auto Factory Almost Runs Itself

[*Continued from page 177*]

monorail for its 120-minute trip through the 1,125° tempering furnace.

Quenching again takes place at the end of the tempering, with automatic transfer to another monorail coming next. A shot-blast cleaning removes "burn-off" scale. The shafts then are taken from the monorail for center drilling—the establishment of center points upon which all subsequent machining is based. Inspectors gauge and test for possible defects, then send the cranks to shipping.

Ford's Cleveland engine plant is another standout example of automation, applied to a different phase of auto manufacture. Foundry-fresh engine blocks march like those animated TV commercials through a series of 43 machines in a line 1,545 feet long, where 530 cutting and drilling operations are performed on each block. From rough casting to finished product they are untouched by human hand.

At Buffalo, more than 2,000 tons of steel move through Ford's automated body-stamping plant daily, emerging as car roofs, floor pans and rear decks.

Plant Loads 50 Freight Cars

This layout, with 96 presses and 19 press lines, is big enough to allow indoor loading of a train of 50 freight cars.

Sheets of steel are loaded automatically into the first huge stamping press on a line. Sections are blanked, formed and sped on their way for flanging, piercing, cutting and trimming. Completely stamped body components from two or more press lines move together into electric welding machines and are joined into finished parts. Throughout, automatic loaders, extractors, turn-over devices and "iron hands" take over the heavy labor once performed by human brawn. END

Fish Story

Housewife: "I don't like the looks of that codfish."
Storekeeper: "Well, if you want looks, why don't you buy a goldfish?"—*Saw Engineer.*

The Spotlight's on Sports Cars
Cadillac El Dorado
Buick Skylark
Oldsmobile Fiesta
Right in the center of the stage, focal point of all eyes, stand these sleek 1953 "sportsters" —important contribution to the fine-car field— completely American through and through.
They are All-American in equipment, too, with AC Spark Plugs sharing the spotlight with these new beauties. All of them rely on ACs to spark their high-compression, high-efficiency engines into new "highs" of performance.
Here's proof that ACs with patented CORALOX Insulator meet highest quality standards. More proof will be found in their smoother, longer-lasting, gas-saving performance in your car.
AC
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CORALOX
INSULATOR
SPARK PLUGS
Original Equipment on Nearly as Many New Cars as All Other Makes Combined.

I STARTED SAVING WHEN I INSTALLED A MILE-O-METER

by Raymond Parsons

I started to save the day I installed a Mile-O-Meter on my dashboard . . . my new seat covers represent the latest proof of that! I get about three or four more miles to every gallon, because the Mile-O-Meter warns me when I'm wasting gas . . . and tells me the relative miles-per-gallon I'm getting as I drive. Using the engine condition scale, I can *see*, instead of *hear*, when my engine needs attention. And, I'm able to make many of the repairs and tune-ups myself, because the Mile-O-Meter shows me how.

It was easy to install the Mile-O-Meter on the dash, without drilling any holes. All the fittings were supplied. All I did was connect it to the intake manifold . . . the directions showed me how. Then I started to save.

I'm really sold on the Mile-O-Meter. If you don't have one on your dashboard, you're probably wasting just as much money as I once did. Actually, you've got everything to gain, and nothing to lose, because they're always sold on a "money back if not satisfied" basis. You ought to send your order in right away.

Raymond Parsons, 90 Tower Avenue, So. Weymouth, Mass., is typical of the thousands of enthusiastic Mile-O-Meter owners.

$14.95
Deluxe illuminated. 1¾" diameter. Chrome trim.

$9.75
Standard Model, 1¾" diameter. Plated trim.

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Orders are shipped within 24 hours anywhere in the U. S. A. We pay postage when payment accompanies order. Add 35c for special delivery, if desired. Each Mile-O-Meter is gift-packaged with all necessaries and instructions included.

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NORTH HAMPTON, NEW HAMPSHIRE

Does Anybody Live on Mars?

[Continued from page 130]

deserts. Sensitive instruments have recently confirmed this hypothesis. Any reflecting surface tends to polarize light—the amount of polarization depending on the angle of incidence and the nature of the reflecting material. If the angle of incidence is known and if the polarization can be measured, the nature of the reflector may be discovered. Using a supersensitive polarimeter with a powerful telescope, a French astronomer has found that the Martian deserts are covered with the same volcanic ash that covers the moon. Even more recently, astronomers at the Mount Wilson Observatory in California have found that silica, a basic component of sand, is present in large quantities on the Martian deserts.

Hot Days, Cold Nights

Surface temperature is a crucial factor in deciding on the possibility of life as we know it on Mars. Using a thermocouple, we have found that the climate on Mars is severe but not impossible.

Like the earth, the temperature range of Mars varies with the seasons and the latitude. However, since Mars is farther from the sun, its average thermometer reading is about 60° colder than ours. The thin Martian atmosphere also permits enormous variations in the temperature from day to night and season to season. Thus, on a summer day at noon the Martian equator may reach nearly 90°. Yet at night the mercury will drop to 40 below or colder at the same spot. So human beings could survive the Martian climate if they were properly equipped.

Lowell believed the Martian polar caps were made of snow and ice which melted in summer. And modern instruments prove that Lowell was right.

If there were on Mars large bodies of water, like oceans or lakes, astronomers could see the reflection of the sun on their surfaces and they could detect water vapor in the planet's atmosphere. The absence of both these signs proves that Mars, true to Lowell's prediction, is a

[Continued on page 262]

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MORE SANDING SURFACE PER DOLLAR means more work done. Faster action (14,400 sanding strokes per min.); more than **three times** as fast as other type sanders!

POWERFUL, high-speed, lifetime reciprocating motor (110 V. 60 cycle A.C.)

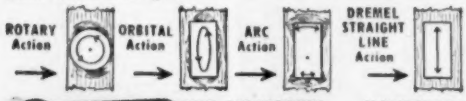
EASY, ONE-HAND OPERATION less tiring on vertical and overhead operations. Sands into corners—other tight places.

TROUBLE-FREE USE assured. Only two moving parts; never needs oiling. No armature, brushes, gears or bearings to wear out and replace.

Professional Model 2000 is a favorite with carpenters, painters, contractors and family handymen! Ideal for finish sanding on flush doors, panelling, cabinets, etc. Superb for waxing cars, polishing furniture, etc.

A "must" for dry-wall joints. Sands into tight corners. Ideal for refinishing.

TRY THIS SIMPLE TEST: Sand a piece of wood by hand, using the four motions below. Note slightest cross-grain action produces scratches and swirl marks. Sanding *with-the-grain* gives scratch-free satin finish. This test proves conclusively why professional craftsmen always sand with-the-grain—never cross grain.



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DREMEL

Does Anybody Live on Mars?

[*Continued from page 260*]

very dry planet. What happens, then, to the water from the melted polar ice? For one thing, despite the huge area of the Martian polar caps, there is little water in them. They are not like the earth's polar fields of snow and ice, hundreds and even thousands of feet deep. The Martian caps are thin, anywhere from 1/10 of an inch to 10 inches thick.

Some Plants May Live

What happens to this water in summer is still a matter of dispute. Many astronomers believe that the moisture is picked up by the clouds and deposited in the form of rain or dew. Others hold that it is carried away by the spongy soil.

As the ice caps melt, the dark regions of Mars change color, the change progressing from pole to equator at 28 miles per day. Lowell's supposition that these color changes are caused by living plants which spring up with the release of polar moisture is still widely held. In fact, there is new evidence to support the theory. Light from Mars' dark areas is similar in some respects to that reflected from lichens and mosses on the earth; and of all the plants known to botanists, only lichens and mosses could survive in Mars' cold, thin, oxygen-starved atmosphere.

Weird Creatures Sidestepped

There is general agreement that life *of some kind* actually exists on the red planet. But there is also a consensus that animal life, as we know it, is either nonexistent or extremely primitive. For although many species of earth plants can survive in an atmosphere of nitrogen and carbon dioxide, manufacturing the oxygen they need through photosynthesis, only a few lowly worms in the whole animal kingdom can live without oxygen.

Of course the phrase, "life as we know it," is all-important when scientists discuss this question. It is easy to imagine forms of animal life, which, like plants, could live on carbon dioxide. But scien-

[*Continued on page 264*]

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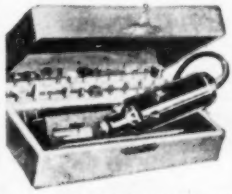

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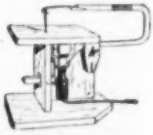

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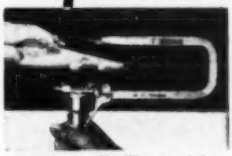
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Does Anybody Live on Mars?

[Continued from page 262]

tists like to discuss what they have information about and can measure with instruments. They know only life as it exists on the Earth, and they prefer to leave speculation about other kinds of life or half-life to science fiction.

Even from this coldly scientific point of view, it is possible that Lowell's highly intelligent race of Martians may still be living on the planet, even though all other forms of animal life have long since perished. For most scientists believe that Mars once had an oxygen atmosphere very similar to our own. After millions of years this oxygen may have combined with the iron in the Martian soil to form iron rust, which, one theory holds, gives Mars its distinctive red color.

Meanwhile, an intelligent race may have mastered the secret of artificial photosynthesis that our own chemists hope to crack before long. Thus, Martians may be manufacturing their own oxygen from the plentiful carbon dioxide in their atmosphere. Or they may be extracting the life-giving gas directly from the rusty Martian soil by chemical processes.

The climate on the planet was once much warmer than it is now, and an intelligent race would have had millions of years to lick the problem of frigid nights.

Canals Would Prove Life Existed

In trying to determine scientifically whether there is an intelligent race on Mars, the "canals" are by far our most significant clue. If the dusky streaks really are canals, then Lowell's case is clinched. But the exasperating fact is that with all our modern instruments we have been able to get very little conclusive evidence.

When Lowell first called them Martian-made canals, and drew detailed maps of their location, astronomers in every country galloped to their instruments. Many denounced him. Some claimed that the canals were a figment of Lowell's imagination, that no such streaks could be seen. Others, using pow-

[Continued on page 266]

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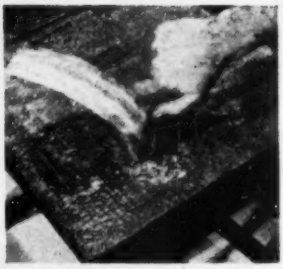

Step 1. *Prepare surface.* Remove all chipped and peeling paint or varnish down to bare wood. You can do this easily and quickly with Strypeeze . . . the *guaranteed* paint remover that stays wet longer, clings to upright surfaces, doesn't harm hands.

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Does Anybody Live on Mars?

[*Continued from page 264*]

erful telescopes, stated that the lines "drawn with absolute geometrical precision" were actually only a series of spots which the observer, in a familiar optical illusion, tended to see as straight lines. And the anti-canalists claimed that the resolving power of Lowell's telescope was too low to have separated out double canals even if they existed.

French Astronomer Converted

Lowell's supporters were equally vigorous. Few were willing to go all the way with his interpretation of the streaks as Martian-made canals, but they did support his contention of single and double tracks thousands of miles long. So the argument has raged, with American astronomers tending to be pro-canal and Europeans anti-canal. The pro-canalists won an important victory when a leading anti-canalist, Gentili, working at the Pic du Midi Observatory in France, switched his position after the close approach of Mars in 1941. He stated flatly that he had seen the canals, that "certain canals were broad and diffuse, others extraordinarily narrow." In a rare piece of scientific crow eating, he assured the reader that "I had taken every precaution to prevent myself from being carried away and 'Lowellizing' my drawings."

What Palomar will tell us is anybody's guess, but many scientists believe that the canals are the last remnants of a great civilization which has long since perished. Because Mars was smaller, and farther from the sun, it has completed its life cycle and now rolls through space a dead planet, except for a few primitive species of vegetation. Some day, say these scientists, space travelers from the Earth may uncover the ruins of a Martian civilization that will make ours look puny. END

Speaking of Colds

A COLD is both affirmative and negative: sometimes the eyes have it and sometimes the nose.—*Pure Oil News.*

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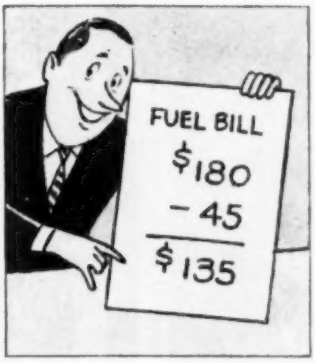
IT'S EASIER THAN YOU THINK—WITH GOLD BOND ROCK WOOL!

Why try to heat all outdoors? You can keep furnace heat in by putting fireproof Gold Bond Rock Wool in your attic. Cooler in summer, too.



Actual tests show insulating the attic can cut fuel bills up to 25%. Savings soon pay the low cost of Gold Bond Rock Wool. All you "spend" is time!

See your Gold Bond lumber and building material dealer. He'll give you printed, easy-to-follow instructions... easy payment terms if you wish.

Start by laying Gold Bond Blankets between floor joists. Blankets come 15", 19" or 23" wide to fit most floors. Keep the "vapor barrier" face down.

If attic already has a floor, you nail or staple blankets to the kneewall and ceiling framing. Your Gold Bond dealer will furnish you a stapler.

Furnace heat stays in, summer heat stays out when Blankets are installed. Gold Bond Rock Wool sticks tight to blanket casing...won't slip or sag!

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Fireproof Wallboards, Decorative Insulation Boards, Lath, Plaster, Lime, Sheathing, Masonry Paints, Wall Paints, Textures, Rock Wool Insulation, Metal Lath and Sound Control Products.

ADD-A-ROOM NOW! with Gold Bond

NOW! SAVE GAS, CUT REPAIRS *as you drive!*

New STEWART-WARNER *"Custom"* MOTOR® MINDER

Gives Constant Check on Engine Performance

A quick look at its illuminated dial shows the way to peak motor performance. Lets you see at a glance how to get most miles per gallon—warns of engine trouble, of sub-standard performance by spark plugs, carburetor, valves, timing, rings, manifold and muffler, etc.

"Custom" model Motor Minder is easily, quickly installed in any car or truck. Swivel mounting for all angle vision. No extra parts needed. Complete instructions for installation and use included.

Motor Minder gives a constant visual check on *all* car motors—even latest high-compression models. Exceedingly accurate. Only $10.95. Install *your* Stewart-Warner "Custom" Motor Minder—today!

Ask for it at your Dealer's—only **$10.95** ***Or Write:***

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Instrument Division, Department P-23
1840 Diversey Parkway, Chicago 14, Illinois

WHY PAY MORE for an ELECTRIC SHAVER?

WHISK AWAY EVEN A 7 DAY BEARD WITH THE WHISKER ELECTRIC SHAVER

Precision-built, with .002" thin blade that shaves all beards smoothly, closely.

Whether you shave once a day, or once a week you'll like WhiskER Electric Shaver. Its clipper-like blade is designed for all beards, is definitely less irritating. 110v AC model; no TV or radio interference. See your barber or dealer. If he cannot supply you, send $15.95—we pay postage; or send $2, you pay balance plus postage and COD. 10-day money-back guarantee.

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Cuts hair, removes superfluous hair from legs and under arms. The same fine quality clipper used and sold in many beauty shops. See your shop, or dealer. If you prefer, send $10.95—we pay postage; or $2, you pay postman balance, postage and C.O.D.

ELECTRO TOOL CORP., Dept. W533-B, Racine, Wis.

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PACKAGED BOAT KITS

EASY TO ASSEMBLE

OUTBOARD CRUISERS from $349.50

SEA-GOING SERIES from $168.50

OUTBOARD RACERS from $119.95

▶ World's finest, most complete line of real performance boat kits! 27 exciting new models: Dinghies, Skiffs, Pontoon Racers, sleek Runabouts, roomy Outboards, Cruisers. Tops in design, styling, construction. Exclusive features for easier, more rapid assembly. Philippine Mahogany pre-assembled frames, brass screws. Easy to follow instructions.

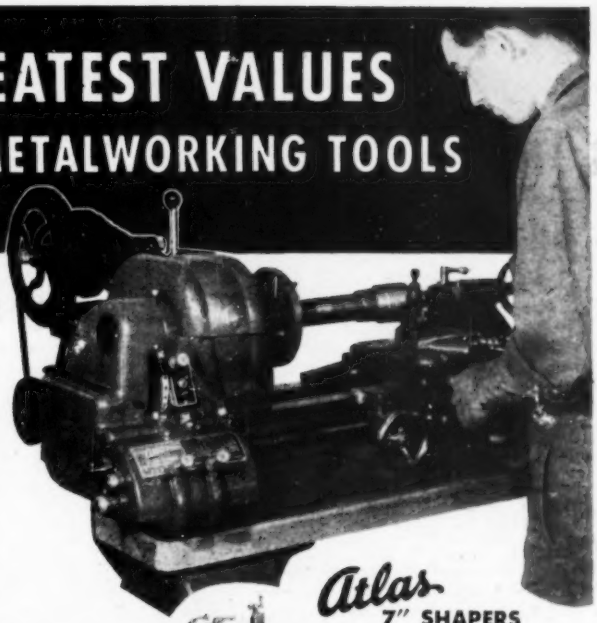
▶ **SEND 25¢ FOR 28 PAGE CATALOG. All 27 models fully illustrated including specifications, performance data plus complete line of marine hardware and paints.**

BOAT PLANS AND FULL-SIZE PATTERNS

Over 100 Modern plans and full size patterns. Racing classes, cruisers, inboards, outboards, sail boats. By famous designers. 6' to 30'. DESIGN CATALOG only 35¢. For Design Catalog plus boat building handbook send $1.00.

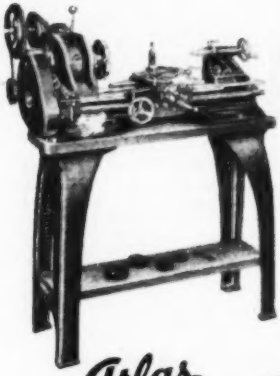
CUSTOM-CRAFT (DEPT. B) BUFFALO 7, N. Y.

Atlas GREATEST VALUES IN METALWORKING TOOLS



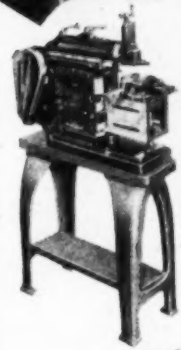
Look them over - see for yourself!

Lower cost . . . easier operation . . . better bearings for longer service — by *every* comparison Atlas metalworking tools give you more for your money! See for yourself — compare. Visit your Atlas dealer, or send for latest catalog. The low prices will surprise you!



Atlas 6" - 10" LATHES

The only 10" lathes with Timken bearings! 16 speeds, instantly reversible power cross and longitudinal feeds, plus many other features. Precision 6" lathes also Timken bearing equipped!



Atlas 7" SHAPERS

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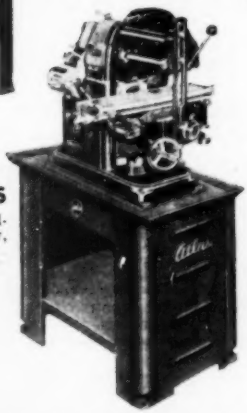

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15" bench and floor drills — and 12¾" bench models — with "floating drive" and many exclusive features for greater accuracy, longer service life.

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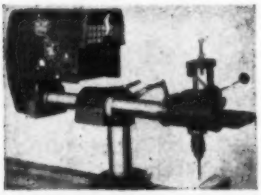
As Ball Bearing Circle Saw

Mitres, compound mitres, cross-cuts, dados, rips, cups, grooves. 8" blade, 2 7/16" cut.



As Ball Bearing Drill Press

3" stroke, 18" throat. Drill, rout or mortise at any angle, in 36" circle.

As Ball Bearing Sander

Either belt or disc locks in vertical or horizontal position, or at any angle.

It's a Circle Saw, Drill Press, Sander, Router, Shaper, Lathe

All in one

The most versatile and useful all-purpose woodworking power tool ever developed . . . a complete workshop in itself! Easy to convert . . . It's light, flexible and simple to operate, yet precision-built to finest professional quality.

All Moving Parts Glide on Ball Bearings

Moving parts glide smoothly, effortlessly on friction-free ball bearings. Easy-to-read calibrations permit quick, precise setting. Locks in any position. Beautifully finished with chrome-plated column crank, lock handles and shaft caps.

V-Belt drive, 4 speeds

Powers other tools

Tools changed in seconds.

Complete with saw, drill, disc and belt sander, and safety type chuck. Mounts on special table . . . . . See other famous individual Shopmaster tools. Other tool accessories available.

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The new "Evans White-Tape" has everything you'll find in tapes costing over $1.50—plus.

- snow-white blade with bold, legible, jet-black numerals and graduations. Graduated in 32nds for first 6 inches.
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- every "Evans White-Tape" is unconditionally guaranteed.
- exclusive Evans automatic brake gives smoother push-pull action with absolutely no "creeping" of tape into case.
- underside is white, too. Mark with ordinary pencil, remove mark with flick of thumb.
- unheard-of low price*: 10-ft. $1.49; 8-ft. $1.19; 6-ft. 98¢. Prices higher in far west and Canada.

Sold only through retailers.

Evans & CO Elizabeth, N. J., Montreal, Que.

Chevrolet Gets Power Steering

[*Continued from page 105*]

valve and a governor. Now, with the selector lever in Drive range, the car automatically shifts into low gear at low speed or a stop. On acceleration, the governor, spun by the transmission main shaft, keeps trying to up-shift the gears. The throttle valve, responding to intake-manifold pressure, keeps trying to prevent the up shift. The manifold pressure drops as acceleration levels off. At that point the governor wins and the car goes into high.

More Zip at Low Speeds

Like the change in the Buick transmission (p. 159), this gives the Chevrolet a snap it was lacking. Like the Ford, the car now up-shifts and down-shifts by itself. But while the Chevrolet and the Ford use the same mechanical-hydraulic principle, there's a marked difference in application.

Chevrolet's assisting gears give you oomph at the rear wheels for city driving. Ford's assisting gears are designed for a better take-off when the light changes, too, but Ford's down shift when you put the pedal on the floorboard is called a "passing gear." It's intended for cutting out and around on the open highway.

The Chevrolet's refurbished transmission starts you out in low gear, Ford's in intermediate. The Chevvy up-shifts at anywhere from 10 to 40 miles an hour, depending on how much accelerator pressure you exert. The Ford up-shifts from 18 to 58. With the throttle closed, the Chevvy down-shifts automatically at 10½ m.p.h., the Ford at 12.

Less Gas Is Used

In Drive range, you can't hold the Chevvy in low gear beyond 40 and you can't hold the Ford in intermediate beyond 58. Both cars, of course, have an emergency-low setting on the selector quadrant.

It is by deliberate choice that Chevrolet uses low gear for take-off. Its engineers reasoned that the torque con-

[*Continued on page 304*]

Ride this great new

MODEL K

for amazing speed, breathtaking thrills, sensational fun and excitement!

TWIST the throttle on a Harley-Davidson Model K and get set for a spine-tingling, thrill-packed ride. Make the dirt fly with the motorcycling gang at field meets, club events and endurance runs. You'll like the cushioned comfort that's assured by the new swinging arm rear suspension, hydraulic telescopic fork and foam rubber saddle mounted on floating twin seat ports. And as for speed, count on the dependable 45 cu. in. twin engine to help you crack records wherever you go.

Try a ride at your Harley-Davidson dealer's today. Bring a buddy along. Or send 25¢ for illustrated literature and a copy of the Enthusiast magazine, filled with exciting stories. Harley-Davidson Motor Co., Dept. **PS**, Milwaukee 1, Wis.

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MODEL K

BUILD YOUR OWN TILTING ARBOR SAW!

SAVE $50 OR MORE

Exclusive GIL-BILT Build-It-Yourself Features

- No machining—build easily with hand tools only
- No blueprint reading—step-by-step pictorial plans, full scale patterns, actual photographs
- Sturdy wood, aluminum, and steel construction
- Capacity and performance of commercial saws selling for $60 and up

GIL-BILT 10-INCH TILTING ARBOR SAW

- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high, table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ½" bore blades, alum. housing, shipped ready to run
- Jackscrew and 1" in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jack screw mechanism and handwheel, and all other metal parts (less blade).....$21.95
Same Kit with 10" Combination Blade....$24.90
Same Kit with 8" Combination Blade....$23.90

GIL-BILT 8-INCH TILTING TABLE SAW

- 21x27 in. table tilts full 45 degrees, 13 in. capacity in front of blade
- 8 in. blade cuts from 0 to 2½ inches
- New Departure ball bearing arbor, ¾" precision shaft turned down for ½" bore blades, alum. housing, ready to run
- Cast aluminum miter gauge and self-align. rip fence guide (same as above)

GIL-BILT Metal Parts Kit includes Plans, Ball Bearing Arbor, Miter Gauge and Bar, Rip Fence Guide, Machined Lock Knobs, Tilt Support Segments and All Other Metal Parts (less blade)....$15.95
Same Kit with 8" Combination Blade.....$18.90

GIL-BILT 12-INCH BAND SAW

- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 16x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅝" bore Oilite Bronze bearings.
  - Upper wheel tension and tilt mechanism of cast aluminum, completely assembled.
  - Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws
- Rigid cast aluminum wheels fully machined ready-to-install. Heavy rubber tires.
- Uses standard 58 inch blades up to ⅜ in. wide.
- Fully enclosed mechanism for utmost safety.

GIL-BILT Metal Parts Kit includes Plans, rubber tires, aluminum wheels, ¼ in. blade, ball bearing spindle, tilt mechanism, blade guides, table tilt segments, and all other metal parts.....$21.95

GIL-BILT BELT SANDER

- 84 sq. in. sanding surface. Over 4 times the effective area of a 10 in. disc sander.
- Belt operates in either vertical or horizontal position, does all sanding operations.
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- Spindle and tension mechanisms of cast aluminum, completely machined and assembled.
- Belt travels 1800 ft. per min. Over a MILE of scratch-sanding action every three minutes. Saves more "elbow grease" than any other tool.

GIL-BILT Metal Parts Kit includes Plans, ball bearing spindle, 4 in. driver drum, 3 in. tension drum, tension mechanism, table tilt segments, rubber tires, cloth sanding belt, and all other metal parts **$16.95.**

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MOTOR RECONDITIONER KIT

No need for costly overhauling. Simply pour P.V.R. Compound in carburetor to clean engine; remove gum, tar and varnish. Then squeeze RING-RE-NU in cylinders . . . forms a pliable, lubricating seal around worn rings. Restores power and compression, eliminates oil burning and piston slap. Good for 10,000 plus miles . . . applied in a few minutes. Order Genuine RING-RE-NU . . . not a foreign import. Made in America for American engineered engines. Guaranteed not to harm your engine.

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CONTRACTORS: load skip mixers, small trucks, level earth! **MUNICIPALITIES:** clear snow, back-fill parkway trenches, control weeds! **FOUNDRIES:** many uses! **FARMERS, ESTATES:** clean barn, till soil, plow snow, etc.

6 FOOT LIFT!

Also A

Powerful Bulldozer

Mead's "MIGHTY MOUSE" HI-LIFT Tractor-Dozer *pivots within its own length.* Weighs only 1300 lbs. yet dozes and hydraulically lifts a 5 cubic foot capacity bucket up to 6 feet! Machine only 40½" wide, 95" long, 2 speeds forward—1 reverse, 6 H.P. engine. M6 HI-LIFT'S size, maneuverability make it ideal for contractors, municipalities, railroads, farmers, estate owners—where larger units cannot work. Accessories such as dozer blade, mower, etc. available. Write for Free Circular. (Dealers write!)

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HIGH SPEED DRILLS

1/4" to 1/2" with 1/4" Shanks
1/2" to 1" with 1/2" Shanks

DRILLS UP TO 1 3/16" FOR YOUR 1/2" DRILLS!
Will Fit Any Size Chuck 1/2" and Larger.

SIZE	PRICE EA.	SIZE	PRICE EA.
33/64	$ .91	25/32	$1.86
17/32	.91	51/64	2.05
35/64	1.14	13/16	2.05
9/16	1.14	53/64	2.15
37/64	1.24	55/64	2.25
19/32	1.24	7/8	2.25
39/64	1.30	15/16	2.43
41/64	1.43	31/32	2.50
21/32	1.43	1-1/32	2.80
43/64	1.55	1-1/16	3.05
47/64	1.80	1-5/64	3.56
3/4	1.80	1-5/32	3.98
		1-3/16	4.10

HIGH SPEED DRILL BITS UP TO 17/32" FOR YOUR 1/4" DRILL AND HIGH SPEED DRILL BITS UP TO 1-3/16" FOR YOUR 1/2" DRILL. The Tungsten steel content of these drills means they will outlast carbon and regular steel drills many, many times. New [illegible]

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Will Fit Any Size Chuck 1/4" and Larger

SIZE	PRICE EA.	SIZE	PRICE EA.
1/4	$.30	25/64	$.60
17/64	.45	13/32	.60
9/32	.45	27/64	.65
19/64	.48	7/16	.65
5/16	.48	29/64	.73
21/64	.50	15/32	.73
11/32	.50	31/64	.75
23/64	.55	1/2	.80
3/8	.55	33/64	.90
		17/32	.90

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SET 4J 5 different size cutters. Can be used as mounted milling cutter or circular saw. All with 3/8" and 1/2" shanks, widths up to 1/4", dia. up to 1". New and used. Ppd. Priced at only.... **$3.95**

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7 different pcs., High Speed 1/4" shank. PPD. **$4.49**

SET 22J 14 different pcs. as above. PPD. **$8.79**

MOUNTED POINTS WITH 1/8" AND 3/32" SHANKS
Assortment of:
10 stones $1.20
25 stones $2.75
50 stones $4.50

COMPLETE SETS OF H. S. DRILLS, ALL WITH . . .

1/4" shanks from 1/4" to 1/2" by 64ths. 17 drills—only..... **$ 7.98**
1/2" shanks from 1/2" to 3/4" by 64ths. 17 drills..... **$19.95**
1/2" shanks from 3/4" to 1" by 64ths. 17 drills..... **$39.50**

COMPLETE H. S. TAPER SHANK DRILL SETS By 64ths.

1/4" to 1/2"; 17 drills..... **$8.95**

1/2" to 3/4"; 17 drills have #2 Morse Taper..... **$14.98**

3/4" to 1"; 17 drills. Drills have #2 and #3 Morse taper ... **$34.95**

HIGH SPEED TAPER SHANK DRILLS

Size	Twist Length	Price Each	Size	Twist Length	Price Each
1 1/64	6 1/2"	2.60	1 3/8	5 1/2"	5.55
1 1/32	6"	2.76	1 25/64	7"	5.75
1 3/64	6"	2.82	1 13/32	6"	5.80
1 1/16	7 1/4"	2.82	1 27/64	5"	5.80
1 5/64	7 3/4"	3.00	1 7/16	6"	6.00
1 3/32	6"	3.33	1 29/64	6"	5.80
1 7/64	9"	4.00	1 15/32	8"	6.13
1 7/64	18 1/2"	8.50	1 17/32	7"	7.16
1 1/8	8 1/2"	4.00	1 35/64	8"	7.25
1 9/64	7"	3.75	1 39/64	7"	7.75
1 5/32	6 1/2"	3.80	1 21/32	7"	8.00
1 11/64	7 3/4"	3.95	1 27/32	7 1/2"	11.00
1 3/16	7 1/2"	3.95	1 7/8	9"	11.90
1 13/64	7"	3.25	1 29/32	6 1/2"	12.00
1 7/32	8 1/2"	3.70	1 31/32	7 1/2"	10.00
1 15/64	7 1/2"	4.51	2 5/16	7"	16.25
1 9/32	7 1/2"	5.00	2 7/16	11"	21.50
1 19/64	5 1/2"	5.10	2 15/32	13"	23.50
1 5/16	5 1/2"	5.18	2 1/2	11"	25.00
1 21/64	5 1/2"	5.38	4	9"	34.50

HIGH SPEED STRAIGHT SHANK CHUCKING REAMERS

SET 16K 20 Different Size High Speed Straight Shank Chucking Reamers up to 1/2". New and used. Priced at only..... **$7.95**

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SET 29K 4 right hand H. S. 3/8" straight shank End Mills up to 3/8" dia..... **$3.98**

NEW BUFFING WHEELS

Available in 7", 8", 9" and 10" dia. PPD. Per pound, only **60c**
NOTE: Min. order 5 lbs. Mixture, or all of one of above sizes.

AIR TANK—REGULATOR—MASK

- A4 Tank, 5" x 8". 104 cu. in. vol. 500 PSI $1.50
- Demand Type Regulator complete with 500 PSI pressure gauge. Fits above tanks $1.50
- Mask complete with 14" of hose. Outlet valve. Fits above regulator $1.60

Above equipment suitable for air tanks, compressors, respirators, diving units, etc.

HIGH SPEED STRAIGHT SHANK DRILLS

SET 19K 100 HIGH SPEED DRILLS: 1/4" down. 30 new std. H. S. Drills—70 slightly used sharp drills lengths up to 7". $30 value. PPD. Only.... **$7.98**

SET 7K 12 Different size H. S. straight shank Drills. 1/4" to 1/2", lengths up to 7". Only..... **$3.98**

HYDRAULIC CYLINDERS

2" bore, 7/8" shaft, 12 1/2" stroke. Double action double-end shaft can be mounted stationary allowing cylinder to slide. Wt. 14 3/4 lbs. F.O.B. Tulsa..... **$12.95**

2 1/4" bore Cylinder. 15" stroke. Double action all steel. Rated 3,000 PSI. F.O.B. Tulsa..... **$18.95**

1 1/2" bore Cylinder. 4" stroke. Double action. Rated at 1,000 PSI. PPD..... **$3.95**

LINEAR ACTUATOR

This unit contains three separate mechanisms: a 1/8 h.p. motor operates on 12 to 32 volts DC or AC if magnetic brake is removed. Motor is 7500 rpm; Motor drives ball bearing 120-1 gear box, which operates precision ground screw to give 5 1/8" push or pull. Pulls up to 1750# and pushes up to 850#. Unit has automatic electric switches which cut the motor when fully extended or fully closed, thus preventing harm to unit. Can be used for valve operation, window or door operation, etc. Unit wt. 7 lbs. Gov't. cost over $200. This unit is yours PPD. for only..... **$9.95**

1/20 H. P., 110-VOLT MOTOR

60 cycle A.C. 1550 RPM. bronze bush bearing. 5/16" shaft. Wt. 4 lbs. Used, guaranteed serviceable. Only..... **$3.50**

PRESSURE GAUGES

4 1/2" DIAL, std. quality gauges. Std. pipe conn. Finest brands retailing at $7.00 and up. 15#, 30"-0-100#, 500#, 700#, 800#. Your choice. Each only..... **$4.00**

6" DIAL, high quality gauges. Mfd. by Ashcroft and Crosby. Reg. price up to $30.00. 5#, 6#, 10#, 20#, 24#, 30#, 100#, 300#, 400# and 1500#. PPD. Your choice, each **$5.25**

8 1/2" DIAL gauges, 30"-0-30#, 30"-0-200#, 300#, 500#, 600#, 30"-0-800#, 30"-0-1000# and 1500#. PPD. Each..... **$6.00**

ELECTRIC MOTOR BARGAIN

1/2 H.P. 5,000 RPM, 110 volt, A.C. or D.C. 1/2-20 thd. shaft. Ideal for routers, grinders, etc. PPD..... **$14.98**

24-VOLT TRANSFORMER

110-volt A.C. to 24-volt, 3 amps. Just the thing for your small 24-volt motors.. **$1.95**

PESCO HYDRAULIC GEAR TYPE PUMP

Rated at 3 GPM, 3750 RPM, 1500 PSI. 1/2" drive spline. Gov't cost over $90. Yours for only... **$9.49**

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Complete with throw-out type clutch. Case has 3 mounting brackets. 3/8" input and output shafts. Gears encased, life-time grease seal. Ball-bearing throughout. (8 ball-bearings) Wt. 6 1/4 lbs. Suitable for winches, boat hoists, traversing mechanisms, PPD..... **$6.95**

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5/16" dia. input shaft, 1/2" dia. output shaft with removable sprocket. Wt. 6 lbs. PPD..... **$5.45**

6 Slitting Saws with Mandrel

SET 34K 6 different size high speed slitting Saws, 5 pcs. 2 3/4" dia. x 1" arbor, plus 1 pc. 5" dia. x 1/2" arbor. Thickness from .040 to .071. Cuts wood, aluminum, brass, steel, etc. PLUS SPECIAL MANDREL which enables use of saws in 1/4" or 1/2" electric drill. $25 value. PPD. Only **$4.95**

7 selected, sharp H. S. Slitting Saws as above to use on your own mandrel or milling machine. New and used. PPD. A bargain at **$4.95**

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60 Degree Angle of Countersink

Size	Size of Drill	Body	Price Each
A-1	3/64	1/8	.25
B-1	.055	5/32	.25
E-1	3/32	3/10	.60
E-2	1/8	3/10	.60
M-2	9/32	5/8	.90

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90-DAY FACTORY GUARANTEE

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HAS TILTING TABLE FOR Sanding, Grinding, Buffing, etc.

No. 400 $7.95

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Item #301 — Model 125 to charge 6 and 12 volt batteries—12 volts—300 Watts; Heavy Duty Generator; Push button self-starter; 2 qt. gasoline tank in base; Ammeter; Generator cut-out; Concealed coil, etc.; Speed and charging rate control; Attractive orange finish; Weight 93 lbs.; Length 15½", width 11¾", Height, 14¾". F.O.B. Chicago..... **89.00**

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ITEM #350

LOGAN AIR CYLINDER Item #350 — Double acting pneumatic cylinder, 6" bore, 6" stroke, 1½" shaft. Adjustable cushions at both ends. Flange mounting at shaft end. Overall length closed 18". Ideal for use in 125 PSI systems. Shipping weight 40 lbs. F.O.B. Chicago.... **39.50**

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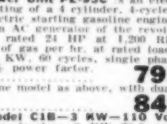

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ITEM #59

ITEM #1036

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 PSI line pressure is 12,500 lbs. Ship wt. 30 lbs. F.O.B. Chicago. An Excellent Buy for..... **32.50**

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1000	7069
1500	10604
2000	14138

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10'	65'	200	5.2	3500
10'	80'	40	1.5	2500
10'	50'	140	5.0	3500
10'	30'	100	3.0	2500

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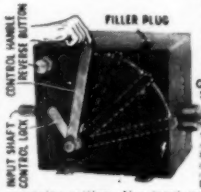

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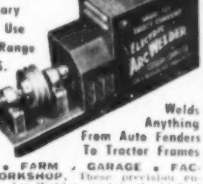

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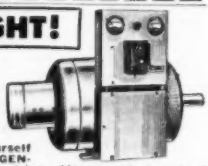

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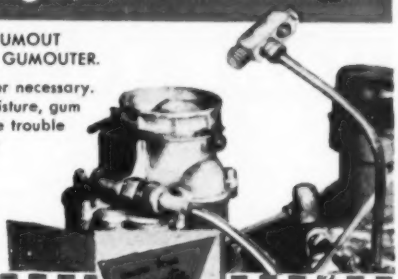

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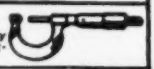

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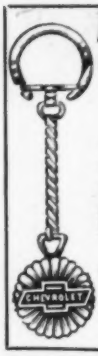

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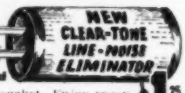

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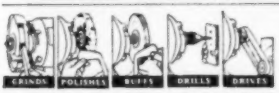

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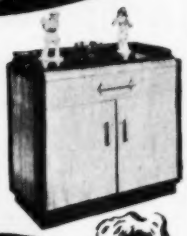

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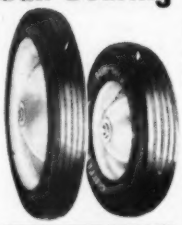

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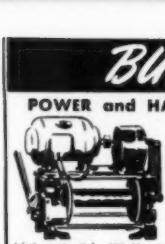


For—BOATS, TRUCKS, FARMERS, LOGGERS, CONTRACTORS, ETC.

Hand winch, 3-1 ratio, 600 lb. pull, drum has 1⅝" spool, 6" flange, takes 75' of 3/16" cable, stop locking pawl, wgt. 26 lbs. **$16.95**

Ball bearing Hand winch, low ratio 1-1, high ratio 3-1, 600 lb. pull **$29.50**

Same as above with bronze worm gear, 12 to 1 ratio and handbrake **$39.50**

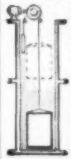
½ HP electric ball bearing model; compact gear box, 12 rpm drum speed **$145.00**

¾ HP, same as above, 3" drum **$165.00**

Heavy duty, 10-1 ratio, double drum model with jaw-type clutch, wgt. 280 lbs. **$49.95**

CABLE, ¼" preformed stainless steel aircraft, 100 ft. or less ..... **17¢/ft.**

Over 100 ft. ..... **15¢/ft.**



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Get all the convenience of a dumb waiter elevator for store, shop, restaurant and home—or the convenience of an incline elevator on steep lake shores, hills, ravines, etc. at lowest cost. We furnish complete parts, Steel Car–Guide Rails–Worm Gear–Limit Switches–Electrical Control–Steel Cable. SEND 25c for completely diagrammed instructions with list of parts, kits and prices.

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Motor driven (not a vibrator). Heavy duty with great power and long life. Adjustable for high, medium or low tone. 110 v. AC current. Weather proof. For alarm or signal horn on boats, school yards, factories, air raid siren, etc. Lists at $47. Our price NEW **$24.95**

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CLUTCHES For Motor scooters, motor bikes, etc. Centrifugal action enables electric motors or small gas engines to handle heavy starting loads. 3" A belt pulley. NEW. ⅝" bore **$9.95**; ¾" bore **$10.95**; 1" bore **$11.95**

CENTRIFUGAL Ball Throw-out CLUTCH. A or B belt pulley. ¾" bore **$9.00**; 1" bore **$11.00**

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2" stroke, 2½" dia., overall length 12". Worth $65.00. NEW only **$6.95**

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300 WATT 110-220 volt AC, 60 cycle light plant powered by 1 HP gas engine, direct drive, mounted base, wgt. 80 lbs. Ideal for campers, P.A. systems, house trailers, etc. Equipped with handle for easy carrying **$99.00**

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To make 110-220 add $40, for transformer.

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50,000 WATT 240 v. AC, 3 phase. Diesel NEW ..... **$5900.**

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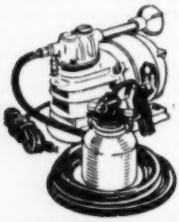

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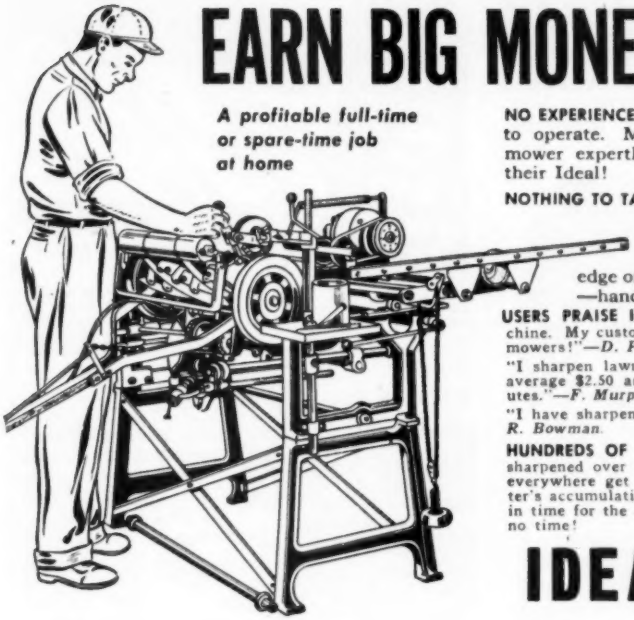

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NOTHING TO TAKE APART—No need to disassemble the mower if you use an Ideal. Put the whole mower in the machine to get a razor sharp edge on bed knife and reel of any mower—hand or power.

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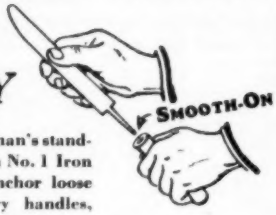

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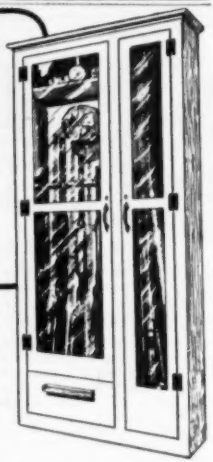

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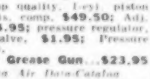

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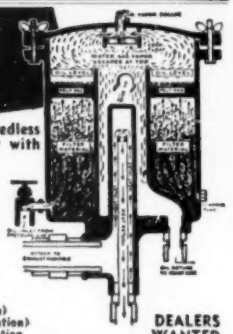

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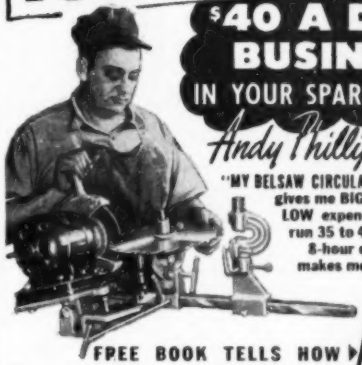

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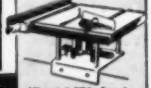

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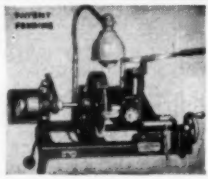

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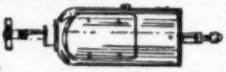

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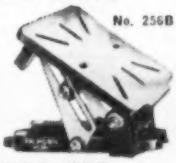

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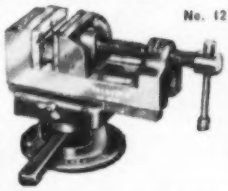

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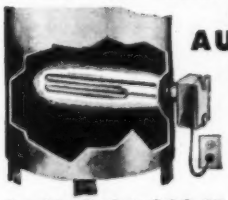

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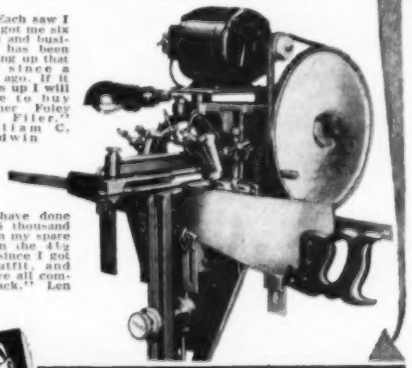

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Add many hours of pleasure to your hobbies. Let this POWERFUL Motor Kit drive model trains, boats, planes, carousels, cars, construction sets, etc. Get this amazing Power Kit. The motor is powerful yet measures only 1x1x1¼ inches. Turns up to 4,800 r.p.m.'s and it's instantly reversible with the new POWER-PACK which holds two standard flashlite batteries. The Power-Pack gives you remote control operation too! PLUS the outstanding Gear Box which gives you ratios up to 81 to 1.

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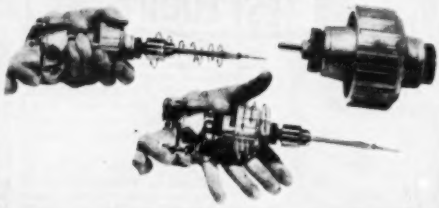

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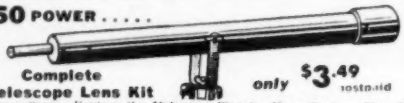

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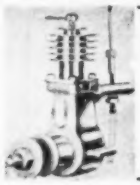

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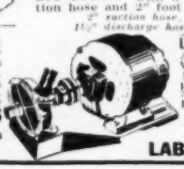

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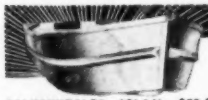

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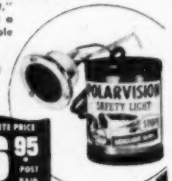

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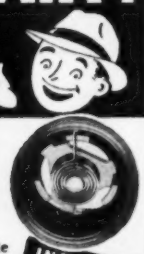

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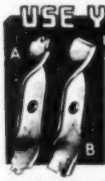

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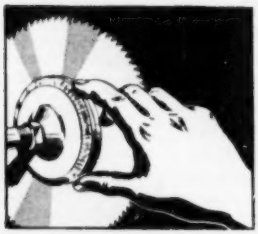

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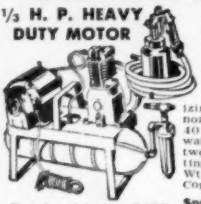

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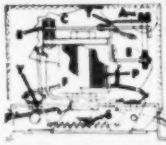

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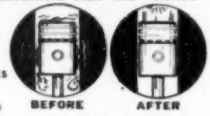

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The new model J5A with ball type flame-proof, metal key. Perfectly balanced to permit positive contact with minimum effort. An ideal instrument for "ham" or professional use. A BUY at . NEW 1.89

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USAF THROAT MICROPHONE

Genuine USAF type T-30-0. Gives clear, distinct voice reproduction for aircraft or the amateur broadcaster. Set consists of two microphones, mounted on rubber neckpiece which is fastened to elastic neck band. Operates on between 100 and 300 ohms. 1.39

NEW RADIO SPEAKERS

Ideal for small radios, inter-com systems, test equipment, etc.

ALNICO—Permanent magnet type. 4" diam. 2 wire hook-up. NEW 2.49

DYNAMIC SPEAKER—10" with plug-in and transformer. 2.95

PERMANENT MAGNET SPEAKER—12" diameter. 2 wire hook-up. 4.25

16MM SURPLUS MOVIE CAMERA

The 'Gun Camera' used by the Navy & U.S.A.F. Electrically operated. Ideal for the amateur or professional movie maker. Lens is a 1-3.8" (35mm) without built-in exposure guide and shade. Adjustable for THREE SHUTTER SPEEDS 16, 32 and 64 frames per sec. Uses regular Eastman (50 ft.) magazines. Comes complete with ZOOM viewfinder and battery box. Requires no winding—operates on 28 volt current applied by ordinary dry cell batteries carried in box that clips on belt. Takes excellent Black & White or Full Color films. Cost Gov't approximately $300.00. 49.95

CONVERTED MODEL—Rebuilt with a special "C" mount adapter for any standard 16 mm Movie Lens. 59.95

FILM (50 ft.) B&W—$3.00 Set of Batteries—$1.79

NEW PIANO HINGE

1¼" x 53½" Cad. Plated Steel . . 89c

1¼" x 72" Aluminum 1.29

3½" x 54" Stainless Steel 1.95

PALLEY SUPPLY CO. Dept PS2, 2263 E. Vernon Ave., Los Angeles 58, California

Chevrolet Gets Power Steering

[Continued from page 272]

verter is at its worst on gas consumption in stop-go driving. Now, the gear reduction in the gearbox and torque converter "at stall"—at the moment the car starts to move—is 3.8 to 1 to give maximum miles-per-gallon in city driving. That's greater, by the way, than the reduction in low gear in the Chevrolet standard transmission—2.94 to 1.

More Power for Passing

As in all torque converters, the gear reduction (or torque multiplication) rapidly decreases as the car gains speed. At the up shift the torque converter is still multiplying the effort of the engine, but presently engine and propeller shaft are turning at approximately the same speed.

The revised transmission includes a converter with a diameter 1⅛ inches greater to transmit more power for passing on the highway. But its economy will be its biggest appeal. Only a hot-rodder won't be able to get two to four more miles to the gallon out of a '53 Chevrolet over a '52.

The brakes are a lot softer now. The engineers did that simply by reducing the diameter of the master cylinder by an eighth of an inch. This puts a third more pressure in the hydraulic lines for any given amount of push on the pedal.

The new Chevrolet has other refinements. To eliminate the necessity of replacing the whole exhaust pipe when the back end rusts out, Chevvy now provides a 12-inch section of aluminized steel tube in this troublesome department. The flasher indicators for the turn signals have been transferred from the steering column to the dash. Tail, stop and turn lights are enclosed in one housing. An automatic headlight dimmer is optional. All models, Powerglide or no, have automatic chokes.

Body Looks Bigger

The car has a bigger, more massive look: the company invested millions of dollars in a complete new set of body dies. The hood is flatter, the fenders longer. There is more glass area. All models in the two top lines have wrap-around rear windows. The amount of added trunk room, achieved by doming the lid, is astonishing.

But the big news is still under the hood. The guy who made that secret test run to the top of Pikes Peak last summer had to sweat out an equally secret run in 110° heat on the Arizona desert a week later. He tells me the car worked like a charm there, too. END

FACTS ON '53 CHEVROLET

Model: 210 series 4-door sedan.

Engine: 6-cyl. valve-in-head; 115 hp. at 3,600 r.p.m.; compression ratio, 7.5:1; piston displacement, 235 cu. in.; piston travel (in feet per car mile at 20 m.p.h.), 1,742; bore and stroke, 3 9/16" by 3 15/16"; crankshaft bearing surface, 29.8 sq. in.; torque, 204 lb.-ft. at 2,000 r.p.m.

Weight: 3,515 lb.; per hp., 30.5 lb.

Transmission: Powerglide torque converter; rear-axle ratio, 3.55:1.

Steering ratio: 17.4:1 (power steering); radius of turning circle, 18¾'.

Effective brake-lining area: 158 sq. in.

Springs: front, coil; rear, semi-elliptic.

Outside dimensions: height, 62⅞"; over-all length with bumpers and guards, 195½"; width, 73 29/32"; wheelbase, 115"; overhang, front 32 9/16", rear 47 15/16"; tread, front 56 11/16", rear 58¾".

Inside dimensions: seat-cushion width, front 59 29/32", rear 60⅝"; leg room, front 42⅞", rear 41½"; headroom, front and rear 35¾"; seat height, front 13 7/64", rear 12 39/64"; vertical distance, steering wheel to seat cushion with seat in mid-position, 4⅝"; front-seat adjustment, horizontal 4⅜", vertical ½".

Tire size: 6.70 by 15.

Move to the Rear, Please

FREQUENTLY people give the bus drivers a pretty rough time in their refusal to move to the rear.

However, one member of the fraternity has found a satisfactory solution.

As the bus becomes crowded, this poker-faced driver chants in his nasal monotone: "Ladies and gentlemen, move to the rear, please." Then he adds significantly, "The rest of you stay up front with me."—*McCall Spirit.*

BEDROCK FACTORY PRICES
SAVE MIDDLEMAN PROFITS

MASTER GARDENER

NO PUSHING
SELF-PROPELLED
It's a lawn mower
It's a power sickle
It's a cultivator
It's a rotary tiller
It's a bulldozer
It's a plow

Here at last is a power unit that does everything. Works for you year round. Does terrific job of preparing mellowed deep seed bed without labor. Built-in power take-off to drive pumps, saws, generators, etc. Safety clutch — can't burn out. More versatile and efficient than tractors costing twice as much. Basic self-propelled 2 hp tractor with Briggs or Clinton famous engine. Only **$119.50**

Tractor shown with Rotary Tiller Attachment

Item 206

Snow Blow . . **$39.50**; Rotary Tiller . . . **$42.50**; Sickle Bar-Mower . . **$42.50**; Furrowing Tool . . **$8.75**; Bulldozer . . . **$11.25**; Lawn Mower Hitch . . **$4.50**; Cultivator . . **$8.75**; Disc Harrow . . . **$15.75**. Freight prepaid to most areas. Easy payment plan available.

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range, removes kitchen smoke and odors. Powerful continuous duty motor, 110-120 v. A.C. Quiet, super efficient fan moves huge volume of air (400 to 600 c.f.m.) 8" Fan, wt. 5 lbs., $6.85; 9" Fan, wt. 6 lbs., $7.85; 10" Fan, wt. 7 lbs., $8.85; 12" Fan, wt. 8 lbs., $9.85. HEAVY DUTY 12" fan, enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, and other difficult applications. Wt. 10 lbs. Item 10D . . . $12.95

RUBBER HOSE

New genuine Neoprene Hose—outlasts ordinary rubber 3 to 1. Reinforced with super tough cotton cord plies. Flexible. Easy Flo brass couplings with standard pipe threads for quick connections, included. Pump water for irrigation, stock tanks, home, barn, fire fighting, etc. Pump Gas or Fuel Oil. Save more than 60%.

In. Diam.	1"	1¼"	1¼"	1½"
Length	10 ft.	25 ft.	50 ft.	100 ft.	50 ft.
Price	$5.95	9.25	24.75	43.95	14.75

If specified we will send special hose for gas or oil at same prices.

Variable Speed Selector

(Item 68)

Heavy duty, made by **B. F. GOODRICH** for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists — any operation requiring variable speed. Ideal for midget autos. Employs reliable "trouble free" planetary system. No hydraulic power losses or creeping. Infinite range, smooth operation, easy installation (data included). 3 sizes: ½-1 hp. wt. 36 lbs.; 1-2 hp. wt. 55 lbs.; 2-3 hp. wt. 165 lbs. Reg. list $228, $252 and $352. Our prices . . . . **$79.50, $89.50** and **$114.50.**

HYDRAULIC JACKS

Heavy duty, precision built, smooth, positive acting with built-in relief valve. Hi-lift with screw extensions. Govt. surplus at a fraction of orig. cost. (Handle included.)

1½ ton (Item 208) Wt. 11 lbs. **$6.45**

(Item 208A) Wt. 15 lbs. **$9.45**

3 ton (Item 208B) Wt. 17 lbs. **$11.45**

COMMANDO MOTOR BIKE

Speed to 40 M.P.H. Travels on Any Kind of Road. Amazing 5 Yr. Guarantee

The Commando Motor Bike is new throughout. Advanced engineering—Automatic Clutch provides quick acceleration and easy hill climbing—yet motor idles at will when you stop. No belts or chains. Rugged lightweight 2-cycle engine delivers dependable power with long life. Transmits power direct to rear wheel with modern Dynaro'or. Easy automatic pedal or pull starting. Special control permits pedalling if desired. Perfect balance and comfort. Anyone can ride a Commando Motor Bike—safe and easy. Reduce mounting of motor eliminates hard steering, dirt, fumes and heat. Really trouble-free! Rugged heavy duty cycle, custom built by famed Schwinn. Ride for health and pleasure; ride to work or school; make deliveries. Order now. Easy payments available. Ask for free circular.

New Automatic Transmission

Mileage Up to 150 per Gallon

Commando Motor Bike Town & Country Cruiser Model . . . 1 cyl.—1½ hp. motor, complete—no extras to buy **$199.50**

Commando Motor Bike Super Chief Model . . . Motor cycle-type 24" wheels; large flange-type brakes; heavy spring fork; powerful Commando twin cylinder 3 hp. motor. Complete—no extras to buy **$249.50**

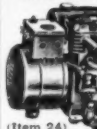
EXTRA! Convert your own pedal bike into a motorized miracle in one hour with a Commando Motor. Complete with easy-to-follow fittings and instructions. Commando Captain Bike Motor, single-cylinder, 1½ hp., Wt. 35 lbs. Complete—nothing else to buy. Item C90. Factory Price . . . **$125.00**

Deluxe Twin-Cylinder Commando General Bike Motor, 3 hp., Wt. 42 lbs. Item C91. Factory Price **$149.50**

Dealers: Send for our special proposition

WORLD'S FINEST GUARANTEED LIGHT PLANTS

PORTABLE LIGHT PLANTS



(Item 24) 350 watts—115 v. D.C. powered by a sturdy, easy-starting 1½ hp. Briggs engine, perfect for lights, radios, razors, etc. in cabins or trailers. Use standard light bulbs. Built-in control box with receptacle — just plug in. Weighs only 65 lbs. Item 273. Reg. price $199.50. A terrific value at **$99.75**

PUSH BUTTON START A.C. PLANT 500-700 watts—115 v.—60 cyc. A.C. Powered by a rugged 2 hp. easy-starting Briggs gas engine. No wiring necessary, just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for Fire Depts., trailers and camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Item 24. Wt. 85 lbs. Fully Guaranteed. **Be prepared if war or storm knocks out power lines.** Reg. $275 value . . . **$143.50**

1000-1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine **$199.50**

GIANT 2000-2500 WATT PLANT

(Item 31)

110-120 V. 60 cyc. A.C. **Absolutely the best made** — exclusive dynamically balanced armatures, heavy windings develop up to 5000 watt overload for motor starting. Skid-mounted—portable. Powered by easy starting Briggs or 6 hp. Wisconsin engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty and complete instructions included. Wt. 220 lbs. Reg. price $585.00. Special at **$299.50**

With Electric Self Starter . . . $359.50

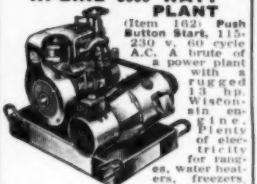
Generator Only and control box. Drive it with your engine or tractor **$169.50**

3000-3500 WATT PLANT

(Item 198) 110-220 v.—60 cyc. A.C. with Wis. Engine. **Push button start.** Wt. 370 lbs. Heavy duty **$399.50**

Generator only for belt drive. Wt. 115 lbs. (Item 198A) **$239.50**

HI-LINE 6000 WATT PLANT



(Item 162) **Push Button Start.** 115-230 v. 60 cycle A.C. A brute of a power plant with a rugged 13 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth $995.00. **With self starter.** Factory price . . . **$645.00**

Generator and control box only, belt driven. Use your own engine or tractor. Wt. 240 lbs. (Item 163) Factory price . **$345.00**

HEAVY DUTY D-C ARC WELDER

with mounting flange

Use as portable or shop welder. Up to 300 amps. Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Easily weld up to ¾" plate using ¼" rods. Built-in air cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. You can pay more, but you can't buy a better welder. (Item 38) Wt. 110 lbs. $400 value at **$99.75**

DUAL CONTROL MODEL same as above but with built-in dual rheostat for low heat soldering, brazing, welding. Spec. **$119.50**

WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at **$10.50**

Write for prices on A.C. Arc Welders.

Factory Prices on Catalog Items

Send 10c for **BIG 1953** catalog. **Hundreds of bargains**

CARRY-AIR

(Item 32) Stainless steel tank — capacity 500 cu. in. at 400 lbs. press., complete with inlet and shutoff valves, press. gauge, detachable air hose, tire chuck. Fill at any service station. Carry air for tire inflation, blowing out lines, etc. One emergency pays back cost. Wt. 10 lbs. Worth $20.00. Our price **$8.95**

(Item 55) With big double tank (1000 cu. in.) **$11.95**

(Item 58) Tank only, 500 cu. in. (no fittings) **$5.95**

EXTENSION CORD

(Item 16) 40 ft. heavy duty, made of specially insulated No. 14 2-conductor wire. So tough that you can drive over it and yet flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2½ lbs. Usually $4.50—Special 40 ft. **$1.99**

Comb: 2-40 ft. and 1-20 ft. (total 100 ft.) **$4.95**

100 ft. length (one piece) **$4.85**

WIRE ONLY (Item 50) No fittings. 100 ft. **$4.00**

Heavy Duty Power Cable

#12—2 Cond.—stranded, very flexible, rubber covered, special outside conductor for grounding power tools, etc. Finest heavy duty power cable made. 50 ft. (Wt. 8 lbs.) Item 199 . . **$6.95**

100 ft. (Wt. 16 lbs.) Item 200 . . . . . **$12.95**

32 Pc. SOCKET SET

32-pc. Socket Set (Item 89) Highest quality guar. non-breakable sockets made by Husky. Beautiful, matched chrome alloy, absolutely the best. Complete range of 21 sockets from ¼"thru 7/16" in ¼" drive and 7/16" thru 1-1/16" in ½" drive; 2 extensions, reversible ½" ratchet, adaptor bit, slide head, all angle coupling, 2 end wrenches, speeder handle and sturdy metal tool box. For prof. mechanics who want the best. Wt. 14 lbs. Easily worth $41.50. While they last only **$16.95**

45 Pc. SOCKET SET (Item 205) Contains a complete set of sockets in ½" drive, ¾" drive and ¼" drive, plus all necessary extensions, handles, speeders, reversible ratchets, etc.; all uncond. guaranteed against breakage. Beautiful matched chromed thin wall alloy sockets in a sturdy handsome steel tool box. Wt. 17 lbs. List price $62.90. Factory Special **$26.95**

MASTER AIR COMPRESSOR

(Item 209) High pressure type for large volume of air for heavy duty service. For paint spraying, inflating truck and auto tires, greasing, and the hundreds of other jobs done by compressed air. Piston type. 2" bore compressor with built-in air filter. Master built with hi-strength alloys and precision bearings. Stainless steel tank, 12"x24", 2100 cu. in. cap. Safe up to 500 lbs. Equipped with automatic switch that starts and stops motor to maintain desired pressure (up to 150 lbs.) and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. Beautifully balanced on ball bearing wheels and rubber tires. Low factory prices.

With ½ hp. 110 v. A.C. motor (Reg. $175.00) (Item 209) **$98.50**

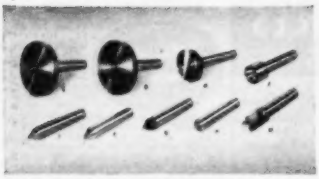
With ½ hp. motor (Reg. $199.50) (Item 209A) **$119.50**

With 2 hp. Briggs Gas Engine (Reg. $199.50) (Item 209B) **$109.50**

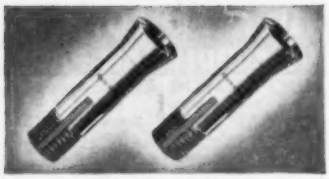
Write for price of compressor only. A complete line of spray guns and air tanks available.

Prices f.o.b. Factory. 10 day Money back guarantee. Send check or Money Order

MASTER MECHANIC MFG. CO., DEPT. 94-B Burlington, Wis.



CENTERS AND DRILL PADS



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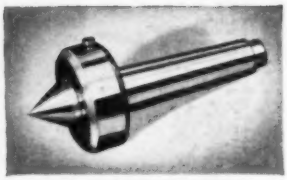

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WITH THESE

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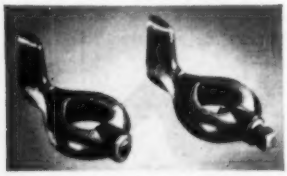

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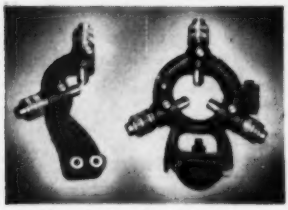

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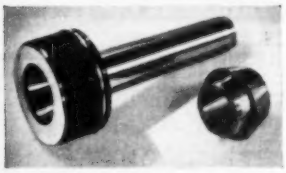

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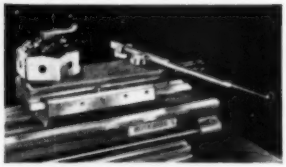

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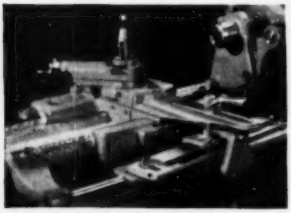

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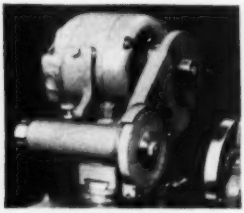

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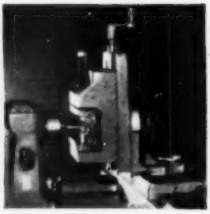

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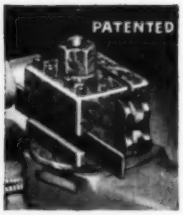

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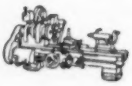

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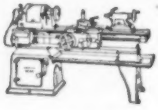
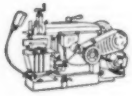


☐ 10" TO 16-24" FLOOR LATHES

☐ 14" DRILL PRESSES



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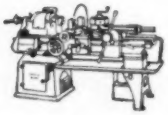

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Professional methods recommended for best results in repair and maintenance of your home were contributed by:

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Here is just a glimpse of what you will find

INTERIOR REPAIRS. How to repair sagging floors —How to fill cracks in floors—Laying linoleum— How to fit and hang doors—Replacing sash cords — Applying weather stripping — How to repair lamp sockets—How to replace electric switches— How to repair electric motors—Repairing leaks in piping—Eliminating noises in plumbing and heating system—Draining plumbing system—Repairing loose, cracked or bulging plaster—Replacing wall and floor tile—Waterproofing basement walls and floors—removing old wallpaper— Painting and Paperhanging.

EXTERIOR MAINTENANCE & REPAIRS. How to locate and repair leakage points on roofs—Reroofing procedures—Shingling—Roll roofing—Repairs to gutters and leaders — Inspection and cleaning of septic tank—Patching cracks in concrete walks and walls—Removal of stains from concrete or brick—Exterior painting—How to avoid blistering, cracking, flaking, alligatoring, wrinkling on exterior paint jobs.

FURNITURE UPHOLSTERY & REPAIRS. How to replace defective stuffing, springs, webbing—How to pad seats—How to make cushions—Foam-rubber upholstering — Repairing broken spindles, rails, legs—Correcting sticky drawers—How to repair scratches, dents and nicks—Furniture refinishing.

HOME IMPROVEMENTS & APPLIANCES. Remodeling basements and attics—Constructing porch screens, storm doors and windows—Building a stairway closet—Constructing garden furniture, fences, gates, pergolas, trellises—Installing three-way push button electrical switch — Installing cooler fans in windows—Air conditioning systems —Automatic coal stoker—How to check and repair electric iron, toaster, ironer, range, vacuum cleaner, dish washer, refrigerator, oil burner— Laying a cement or concrete floor—Building concrete sidewalks, driveways, outdoor fireplace.

WOODWORKING HAND TOOLS & MATERIALS. How to use handsaws, screwdrivers, planes, chisels and gouges, braces and bits, scrapers, squares, levels, clamps, sharpening tools—How to identify and properly use woods and wood products—Working with wood—How to make woodworking joints —Glues and gluing methods.

METALWORKING H
Metalworking saws, pliers and nippers, cold chisels, taps a —Bending and form lishing metal—Faste

WOODWORKING P
checking, adjusting turning lathe, circu jointers and shaper series—Cutting m and Fluting — Mak rabets and dados — and grooving—Mult

METALWORKING P
maintenance of eng electric hand drill, p ing cuts—Finishing turning — Knurling sheet metal—Coun carbon brushes.

PLUMBING & HEAT
and maintenance of Roughing-in materi house drains—Fitt size—Plumbing fix water, steam, warm Chimneys and draft —Domestic water vectors—Radiant he

ELECTRICAL MATE
Indoor and Outdoor Batteries — Transfo Methods of interior ing system—Use requirements.

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ING POWER TOOLS. Proper use, djusting and maintenance of woods- e, circular saw, band saw, drill press, shapers, sanders, power tool acces- ing miters—Bead cutting—Reeding — Making dovetail joints — Cutting ados — Matched shaping — Tonguing g—Multiple cutting.

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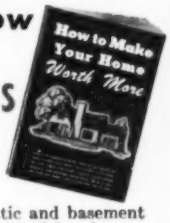

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